THE

ELECTRICAL REVIEW.

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INDUSTRIAL ORGANISATION.

WAR is a solvent of social order which peace will recrystallise into new forms, better or worse. In the unsettling of old habits and prejudices, in the fluidity of general ideas under the intense action of prolonged national crisis, is seen an occasion for recasting much that is imperfect. The liquor traffic, the housing of the poor, the relations of workers to their employers, the morals of great cities, physical training of young men, national education, the political subjection of women; all such questions come into clearer light. We can regard them from a higher and more detached standpoint, in more sober and serious temper, under the stress of a great conflict.

Of all these questions, the problems of industrial organisation, the organisation by which men and women earn their livelihood, and the means to lead their lives, nobly or basely as it may be, are paramount in importance, and industrial organisation in its widest sense includes all home politics, and much of foreign. Some of its most difficult questions now call for immediate solution. Solutions of great problems adopted in urgent need, and under instant pressure are apt to be more successful than those adopted deliberately, for the reason that the urgency rules out narrow and sordid considerations that compromise principle and emasculate legislation. Heroic occasion is the opportunity for heroic action. We have seen national drunkenness abolished from Russia at a stroke. In France every man turned almost at an instant to meet the peril of German domination. Our immediate danger is not so pressing as theirs, but it is more serious than we realise. Our leaders warn, advise, exhort us; but they do not take us into their confidence, and it is not good to treat us as children. Now we have industrial experiment before us on the great scale in several directions. The nationalisation of the railways, whether permanent or not, is a working fact. *British Dyes, Limited*, is under discussion, and letters upon the proposal from Sir William Ramsay and Sir Henry Roscoe, in the *Times* of March 10th, call for most serious consideration. Indeed, in our view the whole scheme, as we understand it, should be recast in the light of those letters, on the ground that bodies of men elected to directorates under the Companies' Acts do, as a matter of experience, depress the scientific interests of their concerns.

To many it appears that the production of dyes should be initiated as a national concern, and protected by prohibition of competing imports. It might well be transferred to an independent body subsequently. The immediate occasion of this article is the proposal of the Government to administer the engineering works of the country in the military interests of the Allies. Elementary considerations of efficiency would indicate such a course, but the fact that the relations of the employers and the men are such that the national safety is compromised by a conflict of sordid

interests makes the step necessary. Indeed, the condition of things recalls the faction fights in Jerusalem when the army of Titus was hammering at the gates. Though occasioned by military necessity, this assumption of the engineering works by the Government may have great consequences as an object lesson in Socialism, and it is fortunate that in the nature of things the arrangement cannot be permanent, so that its action can be watched disinterestedly as if it were only an experiment in State Socialism.

It is impossible to be satisfied with regarding the relation between an employer and a workman as a mere case of supply and demand: for from such a view it follows logically that the employer's interest lies in the workman being as dependent on him as is consistent with working efficiency, and that it is to the workman's interest to keep the employer continually anxious lest his men in a body and without notice should refuse to execute his contracts. A constant state of strain is inevitable. We do not suggest that this view of the industrial relation holds in all or many concerns, but it holds in some of great importance, and, in some degree, in many others. On the other hand, there are well-known large firms in which the human factor is conspicuous in the industrial relationship, and some such concerns are the nearest approach to, are the best models of, the ideal state, that we can call to mind. If this semi-Socialistic step of the Government in taking over the engineering works throws light on this perplexing problem, the war will have that at least to its credit.

The imperative demands that the nation and our Allies are compelled to make upon all connected with manufacturing operations in England were expressed by Lord Kitchener in the House of Lords on Monday. It seems almost incredible that while our sons and brothers are fighting for our existence and sacrificing their lives, there should be amongst us any who are slackers. Successful operations cannot be carried through without abundant and continuous supplies of arms, ammunition and equipment, and we cannot feel that the appeal from the blood-soaked battlefield will fall on deaf ears. The need is so urgent that there ought to be no hampering of manufacturing operations by drink, ca' canny policy, or output restriction by Trade Unions.

The patriotism of the great majority of the workers will undoubtedly be on the side of Lord Kitchener and the Government if short shrift be given to those who prevent our factories from running at their biggest possible capacity. Everybody must be ashamed of men—they are not worthy of the name of Englishmen—who, when the need is so great, will take advantage of higher wages for idling for two days out of the six, and so letting their own kith and kin, fighters for Freedom and Righteousness, who are driving back our Common Enemy, run the risk of being denied, at critical moments, the necessary support from the forces training at home because ammunition and equipment are not forthcoming freely enough.

While this interesting experiment in internal organisation is being undertaken, we are informed of a no less interesting one in business organisation. We have received from the Secretary of a Committee of the Engineers' Club at Manchester a copy of a report, drawn up for discussion, which recommends the establishment of an association of manufacturing engineers for promoting their foreign trade. The work is designed on a large scale, £300,000 a year is the expenditure suggested, and, so far as one can judge from a mere outline, the scheme is well conceived, though we think it is open to criticism on some points. For instance, it is proposed to reform the Consular service "by making the service a special medium for the furtherance of British commercial interests." The relations of our Foreign Office with other Governments, especially with those of dependent States, are often delicate, and depend largely, we believe, on our being disinterested in money matters. These relations might be seriously compromised if the Consuls themselves took an active part in seeking remunerative business for their own merchants. Yet something will undoubtedly have to be done towards removing the inefficiences of the present Consular report service. Whether by the appointment of more Commercial Attachés, Trade Commissioners, or other specialised representatives, matters little, so long as the Government, following consistently its Trade War policy, remedies present shortcomings. We should be sorry to see our Government doing some of the things to which the German Emperor has condescended. It is enough to say that the less the proposed association depends on the Government, and the more firmly it stands on its own feet, the better for it. The weak point of the proposal may be a difficulty in finding the necessary subscriptions. Unless all firms make a *pro rata* contribution we should doubt the permanency of the arrangement, and firms whose trade is wholly a home trade might well refuse. The alternative to voluntary association, if the foreign trade is to be properly pushed, is said to be the formation of combines or trusts, and this the Committee very properly deprecates.

But if we rule out Government action and the formation of large controlling interests, we have ruled out two of the particular methods by which the Germans built up their foreign trade so rapidly. Other methods on which Germany relied, preferential railway rates at home, and arrangements by which the shipping companies were content to run ships at a loss, looking for their profit by the development of new German business in the future, do not seem to be possible in our case. The thing ought to be done in some shape. We are tempted to think that a trading association, on financial lines, looking for a trading profit, instead of relying on voluntary contributions, would be a more promising method.

Municipal Finance.

For very many years we have endeavoured to induce municipalities that conduct electricity supply and tramway undertakings to proceed on sound and conservative lines, accumulating substantial reserve funds and making ample provision for obsolescence and renewal of their plant; for this reason we have deprecated the allocation of surplus revenue to the relief of the local rates, a process which is usually based upon political motives and is intimately associated with the propensity for vote-catching, which is so deleterious to any form of government. Those who have followed our advice, and now find themselves in possession of up-to-date plant backed up by a large reserve, are to be congratulated on their foresight and good judgment; those, on the other hand, that have squandered their

receipts in sops to ratepayers and relied upon raising new loans to meet future needs may now realise the error into which they have fallen, for it is clear that the Government will not allow large sums of money to be borrowed for the purposes of municipal undertakings during the war.

As we are now approaching the period when most electrical undertakings close their financial year, a warning regarding the disposal of surplus moneys will be timely; we strongly urge all such authorities to retain full control of their funds, and absolutely to decline to permit them to be diverted from the service of their undertakings on any consideration whatever.

No one knows how long the war may last, or what the state of public finances may be for years after its close, and it is most important that undertakings which now have to depend upon their own resources should husband them most carefully.

Electric Cooking: From "A" Consumer's Point of View.

It is a good many years since the electric cooker in its embryo state made its appearance with little more than a laboratory reputation and a stiff price to recommend it. In the interval great strides have been made not only in the design of suitable apparatus but also in its use, so that in many cases electric cooking has proved a commercially successful proposition.

This progress in recent times has been largely due to the efforts of the Point Five Association, whose practical methods of dealing with an admittedly difficult problem have more than anything else resulted in placing the electric cooker where it is to-day—in the hands of many consumers. That it is in this position, and is being increasingly sought after, is, after all, the best indication of what consumers think of it, and this fact discounts to a very large extent the impression which is bound to be conveyed to the uninformed reader of Mr. Cooper's paper on this subject before the Institution of Electrical Engineers last week.

It is unfortunate that the author should have chosen to play the part of an investigator of electrical cooking methods, and still more unfortunate that he should have thought it necessary to place his experience on record, as he might have known that his results had been bettered in everyday practice by users all over the country. The average consumer is fortunately *not* an engineer; his installation is selected and fixed under expert guidance, with due regard to first and subsequent costs; and if his anticipations are not realised or his results such as do not compare favourably with those obtained elsewhere, which he is fully entitled to expect, then in nine cases out of ten there is trouble for someone until the matter has been put right.

The fact that Mr. Cooper apparently did not follow this course differentiates him from the ordinary type of consumer, and, of course, detracts from the value of the paper, which was supposedly written from the consumer's point of view. Under the circumstances it is not surprising that the author was practically "snowed under" in the discussion, or rather, we should say, the reply, which followed the reading of his paper, and is published elsewhere in this issue.

It is worth noting that one speaker pointed out that had the author lived in his area (in London) he could have had the requisite installation for a rental of 5s. or 7s. 6d. per quarter, and would have had the utensils supplied free, or, as a purchaser, he could have obtained the equipment installed and wired for use for £14, instead of paying as he did £35. Again, the consumption of energy in such a case as the author's was placed by experience at 3,500 units per annum, but the author's "careful" cook succeeded in disposing of over 5,000 units in the year. Moreover, his allocation of cost as between years with and without electric cooking seems to call for some explanation, in view of the result, which differs so widely from that mentioned by another member, who, during the past five years, has abandoned gas at 1s. 9d. per 1,000 cb. ft. in favour of electricity at the comparatively high price of 1½d. per unit for electric cooking purposes, and yet cannot from a comparison of the combined annual costs of coal, gas and electricity over those five years, find sufficient difference in cost to indicate when he changed over.

Mr. Cooper's references to load factor and diversity factor are not easily understandable; if the cooking consumers are regarded as a class, too much stress should not be laid on individual characteristics, as their combined effect alone will determine their value to the station. It is quite conceivable that a consumer with a large installation and a partiality for week-ends might have a very poor average load factor, while certainly the collective load of the small consumers who will enormously outnumber the large ones is a much more acceptable and profitable one to the central station. In fact, viewed from the standpoint of the future the so-called large cooking consumer could very well be dispensed with.

Mr. Cooper's paper forms one of the very strongest arguments we can have as to the necessity for electricity works to be in a position to advise and to hire out standard cooking equipments to consumers, and to keep in close touch with them afterwards, exactly as our gas friends have done for years.

With all due respect to Mr. Wordingham, who, in the course of the discussion, referred to our leader of February 12th on the question of standardising electric cooking apparatus, we feel that this is a matter which goes somewhat beyond the scope of the sub-committee of which he is a member, and which is apparently inclined to let the matter rest because the manufacturers cannot make up their minds to co-operate in the movement. If electric cooking is to progress on the scale which experience has demonstrated to be possible, it is vitally necessary that the only organised body in this country possessing the collective influence essential to that purpose should take the matter up. We refer, of course, to the I.M.E.A., and we would again urge that this association should recognise the necessity of coming to some agreement with a view to fixing standard lines of development, standard dimensions and ratings, and aiming at some degree of interchangeability, as the best means at the moment for placing electric cooking on a commercially competitive basis, and hastening the introduction of hiring facilities. The manufacturer hesitates because he thinks he can afford to wait; the station engineer, if he is out for business, cannot afford to wait, and if he has any doubt on the matter, a study of the Marylebone load curves ought to convince him.

The Copper Position.

The tone of the copper market remains very steady, not to say firm, and this although it is known that in North America efforts are being made to get increased capacity to work, with the intention of taking advantage of the very remunerative prices which are being realised for metal by the leading producers. The demand is very good on account of the makers of war munitions in all parts of the world, but there is very little business doing in connection with the ordinary sources of peaceful absorption. The whole of the cartridge plants in the United Kingdom are running as fully as the Trade Unions will permit, but it is possible for a good deal more to be turned out than is being done. On the other hand, the French works are making material at a great rate, and it is very fortunate for us that the British Government is able to get large quantities of munitions from the United States. It would be a poor look-out for us were it not that we can call upon the working men of North America to "do their bit" to help the nation to provide the means of offence and defence in Flanders, which are not to be got, except grudgingly, from some of the men at home. It is due to the large orders for cartridges placed in the United States that the American brass

trade is so busily employed, and the activity in this direction is taken as a very gratifying feature, for it has helped to rehabilitate a trade which was feeling the fullest effects of the outbreak of war, and the constriction of credit which followed it, in its early stages. Demands have undeniably outstripped the very low point of consumption which was established last autumn, and an increase in output is thoroughly justified by the growing consumption on both sides of the Atlantic.

Producers are very well sold indeed, and the tendency of prices at the moment is firm both here and in America. There is some demand still met with for early deliveries, but those in the fortunate position of being able to supply needs in this direction are very chary of parting with their material, foreseeing that by holding on they may be able to do still better for themselves later on. There is felt in some American quarters to be a chance of the stocks in the hands of producers being added to in the near future owing to the smaller export movement recently met with, and certainly the February exports were quite small. It is probable, indeed, that the holdings of first hands across the Atlantic have undergone some expansion, possibly as much as 8,000 tons during last month, but this is not likely to cause any discontent generally, for it is recognised that the shipping position is one of the greatest difficulty, and that a restriction in the export movement is due not so much to lack of absorbing power as to the absence for a time of the means of forwarding copper from the producers' to the consumers' works. It is the current belief that American production is now proceeding at the rate of about 40,000 tons a month, and that a steady increase upon this figure is likely to be seen over the next six months or so.

American Trade Development.

Ample evidence is forthcoming that American firms and the American Government are determined to take full advantage of the existing crisis in Europe for the development of American trade at the expense of her former competitors. Realisation of this fact should do much to encourage our manufacturers to do the best that can possibly be done under existing circumstances. In few trades is the activity of American firms likely to be greater than in the electrical trade, for which the United States is particularly well placed. We are constrained to call attention to these circumstances again, because we notice that the American Government has recently caused its Consular Officers abroad to prepare extensive reports on hydro-electric enterprises in various countries, and the outlook for augmented sales of electrical materials and supplies of all kinds. These reports in the main are not being published, but we are able to print certain extracts from one or two of them, under the heading, "Consular Notes," on another page. The complete reports, in manuscript form, are being placed in the industrial centres of the United States, where they may be inspected by manufacturers and exporters. For a variety of reasons many of our manufacturers are at the present moment unable to do very much in the way of trade extension, but we would urge on them the desirability of maintaining a firm hold on their markets, so that when the war is over they may retain the business they previously had, and also assure to themselves a fair prospect of further extension. To this end we would again impress upon the Government the need for developing its present activities on the lines of obtaining from abroad specialised reports on individual trades.

A South Wales Mining Installation.

The paper read by Mr. Sparks on "Electricity Applied to Mining," before the Institution of Electrical Engineers, of which we are publishing an abstract, forms an instructive addition to the previous paper by the same author, which was abstracted in our issue of April 20th, 1906. Progress in the meantime has been such that the station capacity has increased to eight times as much as in 1905, viz., 24,000 H.P.; the B.H.P. of motors connected to 44,800, and the annual output of energy to between 50 and 60 million units, or about 12 times as much. In fact, the scheme is possibly the largest of its kind in the country, and the paper certainly one of the most informing on the subject that we have had.

For generating purposes both live and exhaust steam turbines and gas engines are employed on a fairly large scale, and no doubt there are many who wish it had been possible to include some data relative to the cost of generating as between these different plants.

The author informs us that the gas engines with a 72 per cent. annual load factor require 18 B.TH.U. per watt-hour or half the amount required by the live steam turbine plant, and their operating cost is sensibly lessened by the sale of by-products, but one is somewhat disappointed to find from another paragraph that these 1,200 and 2,400-B.H.P. engines, as the result of experience, are only supplying average loads of 600 and 1,200 KW. respectively, the combined maximum load being 2,200 KW. We may note, in passing, that an illustrated description of the earlier gas engine sets has appeared in our pages.

Very extensive use appears to have been made of exhaust steam turbine plant, and it would seem that a number of steam winding engines have thereby secured a new lease of life; on the other hand, a very fine electrical winding plant on the Ilgner system has been installed at the Britannia Pit, of which some views were included in our pages last week, and there is also a three-phase induction motor-driven winder of smaller size at another pit. The latter has been in satisfactory operation for the last six years, and we gather that the sudden loads of 750 K.V.A., every 45 or 50 seconds, are satisfactorily dealt with at the power station by a Tirrill regulator. Thus the winding problem is being dealt with in various ways, more or less electrical, and it would have given additional interest to the paper had some further reference been made to the conditions determining the choice of means. Mr. Sparks, for instance, makes the general statement that where a colliery is equipped with main steam winders, the cost of conversion to complete electrification is seldom justified; this has been the position for some years, but the conditions have materially altered in that time, and, without further information, it is difficult to gauge the exact position of electric winding at the present moment.

THE SELLING SIDE OF ELECTRICITY SUPPLY.—II.

An Iron Campaign.

With the heating season drawing to a close, one's plans for a spring campaign must be laid, for "business as usual" is still the order. This year economy will, no doubt, be the rule in most British homes, and the housewife will be looking round for possible savings to counteract the advances in food costs. There is one way in which she can do this; in most houses a great deal too much laundry is sent out. There is room for a saving here without reducing the standard of living, and whether the work is done by herself or by the servants, an electric iron will be welcomed. There is an extra amount of washing to be done in conjunction with spring cleaning, and this should be our opportunity. The electric iron is one of the many electrical home conveniences without a close rival. I have often wondered if electrical people themselves realise that it is the delight of those who have adopted it, and one of the last things they will let go. From a supply point of view, the iron is a profit-earner; even if we accept such a low estimate as two hours' use a week for 50 weeks in the year, each iron should consume 25 units, and none of these are likely to be used on the peak load. If we sell 1,000 irons then in the next three months, we shall add 25,000 units to our output, and as most of these will be used on lighting circuits, we are getting lighting rates for power. Good business; now, how to set about it.

First, there is the shop front display. It may be possible to arrange with one of the laundries in the district to send

a girl down with material each day to do actual ironing in the window. This could be kept up so long as results were good—there is nothing so telling as a practical demonstration. They might possibly be induced to do this without charge if the value of it to themselves from an advertising point of view were well put to them. They could be offered a notice, to be fixed by the demonstrator, pointing out that the work done in their laundry was carried out by the same hygienic methods as shown. At the same time the opportunity should not be lost of endeavouring to secure their business.

The large manufacturers of electric irons would be only too pleased to co-operate in finding advertising matter, and are always willing to over-print with your own name.

One of the great barriers to the electric iron is the old sadiron, spirit, gas or charcoal iron already in use. These represent an investment and a habit not always easy to break. One way to get over this difficulty is to offer an allowance for each old iron, as part payment for a new electric one. "New irons for old" can be the slogan. Taking the selling price at about 12s. 6d., and the discount at 33⅓ per cent., the gross profit would be about 4s. One could offer a credit of, say, 6d., for an ordinary sadiron and 1s. 6d. for a gas or spirit iron.

This introduces a bargain feature to the sale which is very dear to the hearts of the ladies, and also gets the old irons out of the way, so that they can't be used. In order to bring in the orders a time limit should be attached to the offer, or perhaps, better still, it could be offered to the first 250 purchasers. If advisable, an extension to 500 or more would follow. This would be, of course, widely announced as being due to the great success of the preliminary offer.

If those of our readers who adopt this idea keep the irons bought in until the end of the campaign and, before selling them to the scrap-iron merchant, pile them up into a heap and take a photograph, we shall be pleased to receive a copy.

Other publicity efforts must be made, advertisements put in the local papers, or if funds will not run to this, notices of such a novel event as new irons for old might well be sent and find a corner in the news columns. The next quarter's accounts could have particulars printed on the back. On the front room might be found for a brief announcement: "New irons for old, see over." A paragraph could be typed into each letter leaving the office to local persons—sufficient use is not always made of this very valuable means of business getting. Of course advertising literature would be enclosed in all outgoing postal communications.

Then there is the question of a house-to-house canvass; if no canvasser is employed, a suitable man might be borrowed from the meter reading department, or perhaps a lady taken on temporarily. It will be found most helpful to offer a week's free trial; only a very small percentage are ever returned. There is no harm in circularising non-users of electric light; it will make them wish they had it, and set them thinking, which is all to the good.

Records should be kept of the number and wattage sold, left on trial, collected, &c., day by day. These records will be found inspiring and useful for the next iron campaign.

With regard to repairs to irons on circuit, charges for these should be kept to a minimum. The most frequent trouble is the flexible getting dragged out of the connecting terminals; anyone can fix this up with a penknife, for cutting back, and a bradawl. A good impression is created if no charge is made on such occasions. Another trouble is the deterioration of the flex; this is largely caused through winding it round the iron when the latter is hot, and so destroying the insulation. A few points such as these might be impressed upon the customer after the purchase has been made; it will obviate much future bother.

The B.A. Meeting at Manchester.—The *Times* states that it has been decided that the annual meeting of the British Association shall take place at Manchester, as arranged, in September next. The meeting will be restricted to its more scientific functions, and there will not be the usual elaborate local hospitality, in the form of social and other arrangements.

LEGAL.

British Insulated and Helsby Cables, Ltd., *v.* Crittall Manufacturing Co., Ltd.

(*Continued from page* 351.)

Further evidence for the defence was given when the hearing was resumed on March 9th.

Mr. A. W. Read, an electrical engineer and one of the defendants' representatives, gave evidence as to the testing of the machine at the plaintiffs' works after which, he said, it was sent back to Braintree, where it was installed with the generator under his supervision, and it was arranged that the clamps should be re-designed for a section for small frames.

By the Referee: The clamp arrangement was new to him at that time, as he had then had no experience. Electrical engineers were not as a rule thoroughly conversant with electric welding.

Examination continued: Subsequently Mr. Bucher, the plaintiffs' representative, made tests extending over two days, and on that occasion he (witness) suggested that the machine might have been inaccurately erected, but he (Mr. Bucher) said he was satisfied that it was properly and well erected. Mr. Bucher tried to make several welds on that occasion, using the clamp which had been made by the defendants, but he met with very indifferent success. He made a number of changes and adjustments in both the clamps and the machine, and, after two days' experimenting, he said that the machine, in its then state, would not enable him to make the tests, and that he was returning to make the gauges and stops necessary. It was arranged that he should do this, and he subsequently paid a second visit. But when he tried to make the welds there was the same indifference which was found in the first test. The only marked improvement was that the clamps were put nearer to the ends of the section. Taking the welds as a whole, they were absolutely unreliable, and blowholes were much in evidence.

On March 10th further evidence was given for the defence.

Mr. F. H. Crittall, a member of the defendant company, described in detail the materials used for the experiments with the plaintiffs' machines, and the manner in which the claims for work done in connection with those experiments were made up. He said that the firm strained every nerve to get the machine to work, as they particularly wanted it.

Mr. Valentine Geo. Crittall, general manager of the defendant company, said that they had been welding by the oxy-acetylene process, which was the best process they had been able to get up to now, and they worked upon the same material as that for which they wanted the electrical machine. Their reason for desiring to make a change was that their oxygen bill was looking big. They desired to try electricity owing to the cost of oxygen, and the fact that the gas process called for certain skill on the part of the operator. It was also understood that by using electricity they would be able to get an increased output. When Mr. Harrison visited the works in 1911, witness took him over the building and showed him what the business was. The material which Mr. Harrison saw at that time was rolled metal, practically identical with that which they asked the plaintiffs to provide a machine to weld.

Mr. Wm. Crawter, electrical engineer and director of the defendant company, who was formerly manager of the defendants' works, gave evidence as to the discussions with Mr. Harrison, which led to the plaintiffs undertaking to make the welding machine. The question of the desirability of using electricity in the place of gas for welding frames was first raised by him. In 1911, he said, he had more than one conversation with Mr. Harrison, who was employed by the plaintiffs, as to the possibility of his company being able to supply machines for the purpose of welding casement frames electrically, and Mr. Harrison said that it would be possible as they had already made a welder for printers' chases, for which a great degree of accuracy was required. It was arranged that samples of the company's material should be sent for welding at the corners. Subsequently the machine was ordered. At first English material was sent for trial, and subsequently German material was supplied, which was better as regards accuracy, and upon that they worked; but the results were not satisfactory. He looked upon the plaintiffs as experts in that particular kind of work, and relied upon their skill and knowledge. The defendants were really anxious to get the machine, and there was no foundation for the assertion that they desired to get rid of it.

A discussion then took place on the application of plaintiffs' counsel that the Referee should visit the works and order experiments to be carried out in his presence.

Mr. Greer, K.C., contended that the Referee had the power to make such an order under Order 50, Rule 4, which said that it should be lawful for any Judge to inspect any property or thing concerning which any question might arise. The Official Referee was brought within that rule. He agreed that the order did not say that experiments might be ordered, but he contended that it was implied. He did not wish the Referee to inspect the machine merely to see what it was like, but he desired that a trial should be ordered to take place in his presence in order that he might see how the machine did its work.

The Referee: Does the defendant object?

Mr. Colam, K.C.: I do.

The Referee said that under the circumstances he would not make an order, but as the matter was of some importance he thought he ought to state his reasons for declining. In the first

place, it was a matter of judicial discretion to be exercised according to settled principles. Undoubtedly the power existed under which he could order experiments to be made, but it was a matter of judicial discretion to say whether it should be done or not. The opinion, or what he might call the verdict of the Judge, must not be given as a consequence of his views as to the results of inspection or experimenting, which were only for the purpose of enabling him to understand and apply the evidence. In this case he did not think, after having heard the evidence, that an inspection was necessary. It appeared to him that he could not be guided rightly, in arriving at a decision, by the results of any experiments which he might see. He therefore proposed, subject to the convenience of the parties, that further evidence should be called if necessary.

Mr. Colam said that if experiments were desired they ought to have been made months ago, and if further expert evidence was to be called he ought to be allowed a little time to call expert witnesses in reply. Of course if the plaintiffs were going to call experts he wanted to know what they were going to say.

The Referee: If you talk much more about it I shall have to alter my decision and go down.

Mr. Walter Francis Crittall, one of the directors of the defendant company, then gave evidence as to a test which was made in his presence after certain alterations had been made in the machine. Those experiments, he said, consisted of making six welds with short pieces of metal, but he did not regard any of them as satisfactory.

The hearing was then adjourned until Monday, March 15th.

Tungsten Drawn Wire.—Licence Refused.

Mr. Justice Warrington, in the Chancery Division, delivered his reserved judgment in this case, reported in preceding issues. His Lordship said he believed this was the first petition under the Section to come before the Court. Sec. 24 provided that any person interested might present a petition to the Board of Trade praying for the grant of a compulsory licence, or, in the alternative, for the revocation of a patent. The Board would consider the petition, and if the parties did not come to an arrangement between themselves the Board, if satisfied that a *primâ facie* case had been made out, would refer the petition to the Court, and if the Board were not so satisfied they might dismiss the petition. If it was proved to the satisfaction of the Court that the reasonable requirements of the public with reference to the patented invention had not been satisfied, the patentee might be ordered by the Court to grant a licence on such terms as the Court might think just. It seemed to him that in order to establish a case within the Section, the petitioner must prove not only default towards himself but towards the public generally. The expression, "trade or industry," seemed to him to be used in a wide sense, as in the case of the expression "woollen trade," or "cotton trade," and the use of the expression "trade or industry" in the petition was not enough to establish that a particular trade was unfairly prejudiced. It must be proved that the trade or industry as a whole was affected. The establishment of a new trade or industry was a different thing altogether from the entry of a particular person into an existing trade or industry. If the default towards the public was established, the Section conferred two alternative rights:—First, the right of the individual to present a petition to have a licence granted to himself; and, secondly, the right of the public to be relieved from the effects of the patentee's monopoly by the revocation of the patent. His Lordship had to determine whether on the facts of the present case the petitioners had established that the reasonable requirements of the public were "to be deemed not to have been satisfied." The two respondent companies, together with the General Electric Co., Ltd., had pooled their patents, and thus controlled, to a large extent, the industry connected with electric incandescent lamps. To prevent the cutting of prices, they required from dealers and licensees that they should not sell below certain list prices. The firms and companies controlling the sale of the lamps were known as the Tungsten Lamp Association, and the result of their action was that the price of the lamps was considerably higher in this country than abroad. There was, however, no evidence that the price was so high as to be a serious burden on the consumer, or to be unreasonable, and the fact was that in the last two or three years the price had been considerably reduced, while the supply of lamps was quite adequate to meet the demands of the public. The petition was founded on the allegation that drawn tungsten wire was a patented article, and that the patentees had failed to supply this to the petitioners, or to grant a licence on reasonable terms, and that the establishment of what the petitioners called a new trade or industry in the making of their lamps had been unfairly prejudiced. It had been shown on the petitioners' own evidence that there was no trade or industry with which drawn tungsten wire was connected except the making of electric lamps, and there was no demand for the wire except in that connection. The petitioners had not proved that the respondents had been guilty of the default indicated by the Act, namely, in the matter of supply for the only purpose—that was filaments in lamps—for which the wire was required, or that the needs of the public were not amply satisfied in this respect. Nor had they proved as regarded the licence any default except in reference to themselves. It was common ground that licences had been granted, and no attempt had been made to show that the terms were unreasonable. In his opinion, the trade or industry to be considered was that of the making of tungsten electric lamps, and this would be nothing more than the entry of a fresh trader into an existing trade or industry. There was no ground for suggesting that this trade or industry had been unfairly prejudiced by the respondents. On the petitioners' own evidence, therefore, he had come to the conclusion that they had failed to establish the case required by the Act, and he must dismiss the petition with costs.

Council appearing in the case were: For the petitioners, Mr. Bousfield, K.C., Mr. Cave, K.C., M.P., and Mr. R. Frost; for the British Thomson-Houston Co., Mr. A. J. Walter, K.C., Mr. J. H. Gray, and Mr. Lunge; for Siemens Bros. & Co., Mr. Colefax and Mr. Hume.

Solicitors for the petitioners, Messrs. Ashurst, Morris, Crisp and Co.; for the respondents, Bristows, Cooke and Carpmæl.

Newcastle-on-Tyne Electric Supply Co. Summoned.

At Newcastle-on-Tyne Police Court on 12th inst., the Newcastle-on-Tyne Electric Supply Co., Ltd., were summoned on the information of Andrew Gemmell, of Castle Nook, Ovingham-on-Tyne, "that they on August 23rd, 1914, being the undertakers within the meaning of the Electric Lighting Act, 1882, did unlawfully make default in complying with the provisions of the Act and of the Electric Lighting (Clauses) Act, 1899, by not selling to the complainant a copy of the annual statement of accounts of their undertaking, made up to December 31st, 1912, the complainant having paid the sum legally demanded for the same; and in such default continued until the date of the laying of the information."

Mr. Charlesworth, for the prosecution, said that Mr. Gemmell was a gentleman interested in electrical business, and he made an application on July 8th, 1914, for a copy of the accounts of the Company, and he also wanted a copy of the auditor's report. Mr. Charlesworth said the accounts in question referred to the year 1912, and were audited in July, 1913, and he maintained that whether the application were made to the Board of Trade or not, the defendants were bound under the section to supply a full copy of the report unless the Board of Trade directed otherwise.

Andrew Gemmell said he made application for a copy of the accounts, with the Board of Trade auditor's report, and sent the statutory fee of 1s. He claimed that if the Board of Trade did not direct to the contrary, he should have had a full copy of the auditor's report.

Witness, in reply to Mr. Burton (who appeared for the company), said that he received a copy of the auditor's report on March 3rd last, but he was not satisfied, because it was two years after the period referred to.

The Clerk (to Mr. Burton): Is it your contention that you are not bound to supply the report of the auditor in the absence of any direction from the Board of Trade?

Mr. Burton: That is my argument. The point was raised by the same gentleman in a prosecution about four years ago, and decided against Mr. Gemmell.

Matthew Short, secretary of the defendant company, produced the Board of Trade report, which he said he received last week. The report was sent in July last year, with a request for observations thereon. The letter of March was the first authorising him to publish the report.

In cross-examination, Mr. Short said they looked upon the auditor's report as a confidential document.

Mr. Burton said the company's view coincided with what they had heard from the Board of Trade. This was a Board of Trade document, and was in the nature of a confidential document and could not be published without the authority of the Board. It was, therefore, necessary that the permission of the Board of Trade be obtained before the company could publish the whole or any part of the report. The company did not get that direction until a week ago—or after the summons was issued. The delay was due probably to the war. At August 23rd the matter was *sub judice*, and it would have been highly improper for them to have supplied Mr. Gemmell with a copy of the report.

The Chairman (Sir Joseph Baxter Ellis) said that the Bench were of opinion that the company had not discharged the whole of their statutory obligations. They thought, however, that there had been many difficulties to deal with, and under the circumstances the magistrates considered the case would be met by dismissing the summons on the payment of costs.

City of London Electric Lighting Co., Ltd., *v.* Bennett.

In the City of London Court on Tuesday, before his Honour Judge Rentoul, K.C, this case was heard, in which the plaintiff company sought to have the defendant, Mr. E. G. Bennett, Ludgate Arcade, committed for the non-payment of £7 7s. 1d. for electric current supplied.

Defendant said he did not think the plaintiffs were going to press for his committal as they were doing, or he would never have used their electric supply. He had lost his all, and after trading for 47 years he thought it rather hard that he should be sent to prison because he could not pay his electric lighting account.

Judge Rentoul ordered payment of 2s. 6d. per month.

R. L. Jones & Co., *v.* Orpheum, Ltd.

Judgment in this case, which was partly reported in our last issue, was given on Tuesday. We shall report the proceedings in our next issue, but may state that judgment was given for the plaintiffs for £136 11s. 10d., the £96 11s. 10d. paid into Court under Order 14 to be paid out in part satisfaction of the judgment.

HERBERT MORRIS, LTD., *v.* SAXELBY.

THIS case came before the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Joyce, upon the appeal of the plaintiff company, who are manufacturers of pulley blocks, overhead runways, electric overhead runways, &c., at Loughborough, from a judgment of Mr. Justice Sargant, in the Chancery Division. The facts were reported in our issue of November 6th, 1914, page 618.

Sir R. Finlay, K.C., Mr. A. J. Walter, K.C., and Mr. Kerly, K.C., appeared in support of the appeal; and Mr. Mark Romer, K.C., and Mr. Sheldon for the respondent.

SIR R. FINLAY contended that, in the circumstances, having regard to the nature of the plaintiffs' business, the covenant in question was not too wide for the plaintiffs' protection, and could not, and ought not, to be construed as in restraint of trade.

MR. ROMER contended that the decision of Mr. Justice Sargant was right, and that the covenant was too wide, and therefore invalid. He agreed that, speaking generally, every employer was entitled to have a covenant which would prevent his employé disclosing trade secrets, with proper limitations of time and space; but he submitted an employer was not entitled to a covenant which would prevent the employé from using the skill and business training which he had gathered in the course of his employment.

At the conclusion of the arguments of counsel, their Lordships reserved judgment.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Country House Lighting Sets.

The generating plant illustrated in fig. 1 comprises a Vickers 6-KW. 800-R.P.M. 100-148-volt, 59-41-ampere dynamo, coupled up to a 10-H.P. Belliss engine, installed at Ampton Hall, and used for lighting and power purposes. Current is supplied for 250 lights in the residence, ranging from 10 C.P. to 50 C.P., the storage battery being of 300 ampere-hours capacity.

On the power side current is taken by a Vickers 2-H.P. motor to drive a pump in connection with the house water supply, and in the garage repair works a Vickers 2-H.P. motor is installed for driving, by means of shafting, a number of machines, including a lathe, grinder, &c.

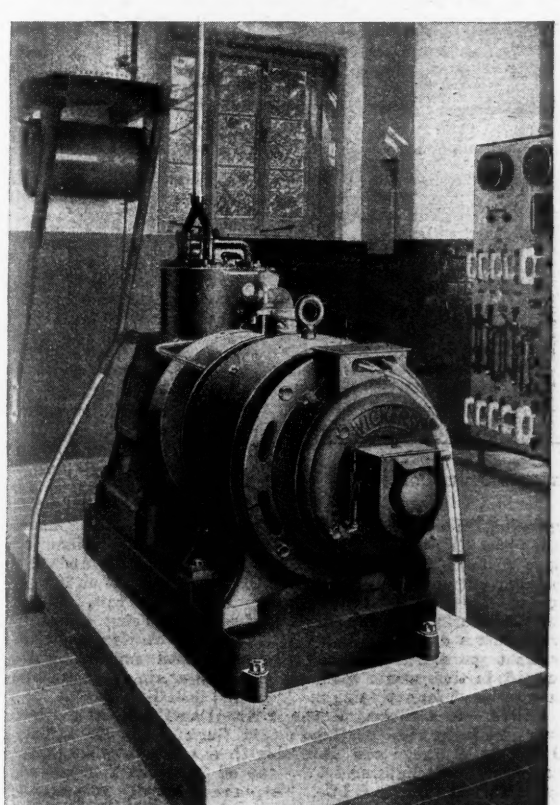


FIG. 1.—VICKERS-BELLISS COUNTRY HOUSE LIGHTING SET.

The entire installation work was carried out by MESSRS. MANN, EGERTON & CO., LTD., under the supervision of Mr. W. C. Hawtayne.

Anti-Aircraft Searchlight.

Amongst other types of searchlights, the LONDON ELECTRIC FIRM, of George Street, Croydon, are at present turning out a new pattern for anti-aircraft and similar purposes, arranged to work at an elevation of as much as 90° (fig. 2). The machine is 24 in. in diameter with silvered parabolic mirrors, and revolves on ball bearings, a geared quadrant with a brake being provided for elevation; and the design eliminates the twisting of the connecting cables. The machines are arranged to work through resistances on 80 volts or higher pressures. The new lamp has the feature of combined auto and hand feed, allowing of adjustment of the carbons whilst still working automatic without any change-over whatever.

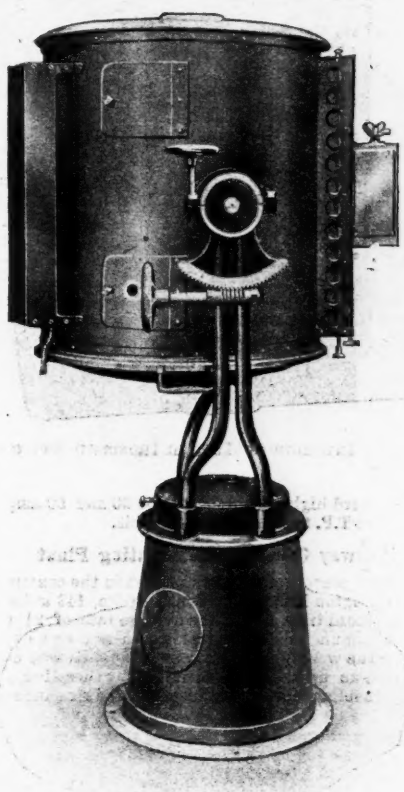


FIG. 2.—ANTI-AIRCRAFT PROJECTOR.

New Pattern "Tucker" Ironclad Switches.

MESSRS. J. H. TUCKER & CO., of Birmingham, have recently placed on the market a new pattern of ironclad switch intended primarily for conditions where a first-class job is necessary, and price is a vital question.

A usual feature in low-priced ironclad switches hitherto has been the "slot" in the centre of cover. The disadvantages of such "slot" are obvious, not the least being the difficulty of "earthing" the handle. A strong feature in favour of the "slotted" cover switch has been its price, that of the solid cover "side handle" type being generally prohibitive in comparison.

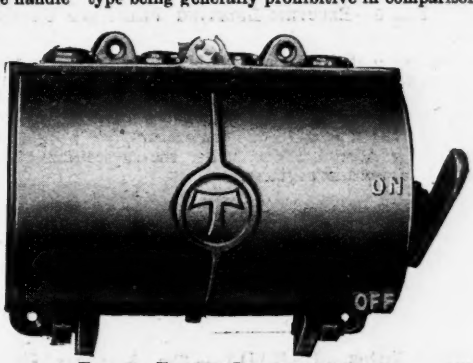


FIG. 3.—TUCKER IRONCLAD SWITCH.

In the new line Messrs. Tucker are combining advantages of both these patterns by (*a*) doing away with the "slot" in the cover, which is solid; the D.P. have "side," the T.P. "Stirrup" handles; (*b*) the handle is in permanent and certain contact with the case for "earthing" purposes; and (*c*) they are making arrangements for the production of these switches in large quantities, so that they will cost no more than the "slotted" cover type, which they will displace.

Each pole is mounted on a separate vitreous china base; the cover is "interlocked" with the handle, and the position of the switch is indicated on the cover.

In accordance with their standard practice every switch case is fitted with substantial earthing terminal, and enamelled and

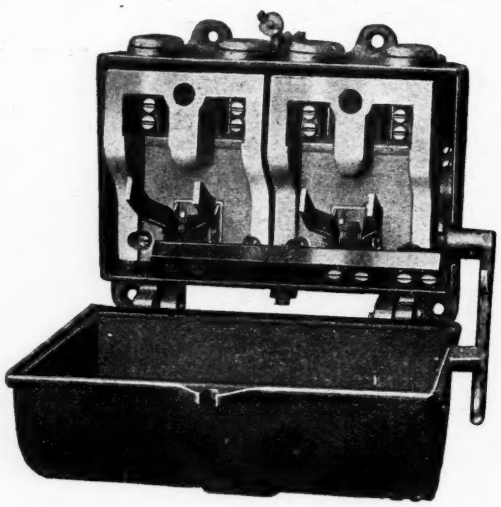


Fig. 4.—Interior of Tucker Ironclad Switch.

"stoved" to a hard high-class finish. The 30 and 50-ampere sizes in both D.P. and T.P. types are now available.

Railway Construction Lighting Plant.

Electric light played an important part in the construction of the Prieska-Upington Railway, in South Africa, 142 miles of track being laid in record time, and at the average rate of 2¼ miles per day. The maximum mileage completed in any one day was 3¼ miles. After the work was properly set going, it was carried on day and night, an up-to-date electric light generating plant (see illustration) enabling operations to proceed after sundown. The

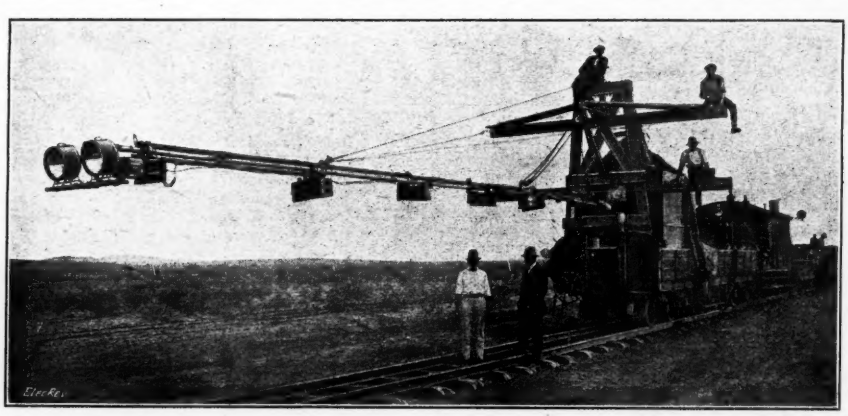


Fig. 5.—Electric Lighting Plant for Urgent Railway Construction.

speedy construction of the line was considered necessary in order to facilitate the movement of troops towards the German South-West border, and to admit of assistance being rendered in the field with the greater promptitude which rail communication would afford. The line was built departmentally by the South African Railway Administration, under the supervision of Mr. N. K. Prettejohn, resident engineer.

BUSINESS NOTES.

Consular Notes.—CANADA.—The American Consul at Cornwall (Canada), in a recent report, states that the 45-mile transmission cable to carry 85,000 H.P. of electrical energy from Cedar Rapids in the St. Lawrence River past Cornwall to Massena (U.S.A.) is now in operation. During the first week of January of this year the current was flashed for the first time along the entire length of the cables. There are six of these cables (two circuits) each cable being aluminium one inch in diameter on a steel core. It is stated that the additional electric power is being used by the aluminium plant at Massena to operate a large increase recently made in this plant in building and equipment. Some of the power is serving for the reduction of the ore in the pot-room of the aluminium works. Cornwall's industries can have the privilege of tapping this transmission line of electric power at a reasonable rate. It is said, however, that it would be necessary to erect a sub-station at Cornwall, costing at least £10,000, before such tapping could be effected.

CHINA.—According to the American Consul at Chungking, there are great potential possibilities for electrical development in Szechuan Province; many of its cities have excellent water powers close at hand, the cost of kerosine and other illuminants is very high, and in numbers its population exceeds that of any other Province. Szechuan is also very wealthy, and sooner or later there is sure to be an era of vast commercial development. Large industrial projects are under consideration, and electrical equipment of all kinds will some day enjoy a very large sale. Owing to the unsettled conditions in China and the war in Europe the trade of the province is at present becoming very slack; adverse exchange and increased prices of foreign articles have caused imports to dwindle. Chinese capitalists, too, have grown timid and hesitate to invest in industrial undertakings. A few years ago the installation of an electric light plant in the city of Tzechow seemed assured; part of the capital had been subscribed, and negotiations had been opened for the appointment of an American electrical engineer. The Revolution in 1911, and the local insurrection of 1913, however, caused those interested to abandon the idea. Recently an influential resident of Tzechow, when requested to give his opinion as to the present and future demand for machinery, stated that at present there was no demand, but there was talk of electric light plants for the city and pumps for the coal mines. The promoters of these schemes do not seem to have got beyond the "talk" stage, but the situation at Tzechow is more encouraging than in other parts of the Province. What the Chinese need most at the present time is money. There are many industrial enterprises which would prove highly profitable, but there is no way to finance them. The Chinese are anxious to develop the country, and many towns would install telephones and electric lighting plants if sufficient money could be obtained. The sale of electrical machinery should, in many cases, be accompanied by a loan, and the companies which adopt this method will very likely secure the bulk of the trade. There is a possible market in the Province for the sale of small lighting plants for theatres and other large buildings. Many private users of current find it advantageous to maintain their own lighting sets; the American Methodist Mission in Chungking has done this successfully for several years, and the Canadian Methodist Mission at Chengtu is negotiating for a private plant.

In a report just issued, the American Consul at Shanghai states that at the present time there is practically no hydro-electric power development in China. Such electrical plants as have been installed in the country are driven almost entirely by steam. The immense delta plains of the Yangtze and Yellow Rivers are not, in a general sense, suitable for hydro-electric plants, but in Fukien, Yunnan, and parts of Shantung Provinces, as well as the Yangtze gorges, power stations of this type may ultimately be installed. While it may be stated broadly that no hydro-electric plants are in operation in China, stations for supplying current to the cities of Yunnan for and Chengtu have been partially arranged for through negotiations taken up by Germans with the Chinese Government. Inquiries made through German sources, however, fail to disclose any pertinent details regarding this undertaking. In other instances, native Chinese companies in connection with Chinese Chambers of Commerce have agitated for the development of waterpowers, and have endeavoured to arrange with the Chinese provincial authorities for permission to build such plants. As a general rule, however, the Chinese have not been successful in organising companies with such a degree of financial backing and standing as would warrant provincial or central governmental support, which support in time would enable foreign engineering firms to enter into contracts for supplying materials and installing plants.

INDIA.—In a recent report the American Consul at Rangoon states that electrical development in Burma is in its infancy. Outside of Rangoon and Mandalay there are no electric plants, except a small lighting set in the oil fields at Yenangyoung operated by the Burma Oil Co. There are practically no privately owned isolated plants in Burma, due probably to the high cost of erection and the very small population able to afford electric light and power. At present kerosene is the almost universal medium of lighting, the poorer natives using Burma oil and the European and wealthy natives American kerosene. While there is no doubt that eventually electrical plants will be erected in the more important towns of Burma little development can be expected in the present distressed condition of trade.

The only electrical plant in Rangoon is operated by the Rangoon Electric Tramways and Supply Co., which has 3,000 residence connections. Its rates are 7d. per British Board of Trade unit for lighting, 6d. per unit for combined lighting and power for fans, and 3½d. per unit for power. To Government railways and other large consumers special rates are given, which average 3d. per unit. This company also deals in electrical supplies of all kinds.

The Burma Electric Tramways and Lighting Co., Mandalay, has 150 residence connections; rates for lighting are 8d. for the first 30 units per month, and 7d. for the next 170 units. Electric fans, both ceiling and wall, are coming into more general use, and are replacing the hand-operated Indian punkahs. Nearly all offices in Rangoon are now equipped with electric fans; also clubs, places of amusement, churches, and the residences of the European community. Practically the only competitor of the United States in this market, in the sale of electrical supplies, is Great Britain, which furnishes four times as much as does America. It is suggested that American manufacturers should be able to supply large quantities of lamps, cooking and heating apparatus, torches, motors, generators, &c.

SIAM.—The American Vice-Consul at Bangkok reports that the Siam Electricity Co., Ltd., had until recently the only light and power plant in Siam, and for 1913 showed gross earnings of about £100,000. The Bangkok municipal power station began operation in the early part of 1914. Both of these stations use three-phase 50-cycle current. The telegraph and telephone systems are operated by the Government.

"Electrical materials and apparatus are not manufactured in Siam, hence materials for renewals and extensions of all electrical enterprises, electric street railway equipment, lighting fixtures, telephone apparatus, cables, insulators, electric motors, fans, batteries, bells, cooking utensils, sadirons, and a variety of similar goods, should be in demand. The possibilities of extending American trade in electrical materials and apparatus might be enhanced by arranging for an exhibit of such goods in Bangkok; also by American firms entering into correspondence with local consumers as to their requirements, by submitting price lists, and by appointing local agents. Agents should be supplied with samples of materials and prices for supplies needed by the Government telegraphs, telephones, and power station, as all such goods are bought through public tenders, and the time allowed is frequently not sufficient to permit bids to be submitted from American firms direct."

Bankruptcy Proceedings.—Stuart Alfred Curzon' described as an electrical and motor engineer, of 175-6, Piccadilly, W., and late of Victoria Street, Westminster, S.W.—The first meeting of creditors was held on March 9th, at the London Bankruptcy Court, under a receiving order. Mr. E. Leadam Hough, senior Official Receiver, reported that it appeared from the debtor's statements that he commenced business in August, 1912, and had the sole right to sell the obsolete motor vehicles of the London General Omnibus Co., Ltd. He sold that business in August, 1914, to the General Omnibus Supply, Ltd., which he had assisted to promote in April, 1912, and which was a syndicate to promote motor-omnibus companies. It had a nominal capital of £10,000, subsequently increased to £55,000. The syndicate promoted Greater Omnibus Services, Ltd., with a nominal capital of £100,000, and the debtor became joint managing director at a salary of £750 per annum. In May, 1914, that Company was amalgamated with the London Premier Omnibus Co., Ltd., and the debtor held a similar position in that company. In March, 1913, the debtor became interested in the General Motor Services of Russia, Ltd., which was formed to take up what was represented to be the sole concession for the running of omnibuses in the Crimea. He put between £3,000 and £4,000 of his own money into the company, and became managing director. He went to Russia to look into the matter, and found that the concession possessed no value, and that a considerable amount of debts had been incurred there by the company. In consequence of that information he dropped the whole business, and the company had now ceased to exist. In May, 1914, the debtor promoted Stuart A. Curzon (Russia), Ltd., with a nominal capital of £50,000 to take up the running of motor-omnibuses in the Crimea in continuation of the work done by the General Motor Services of Russia, Ltd., but, owing to the war, things were at a standstill. It was his intention, however, as soon as the war was over, to carry the business through. A statement of affairs had been lodged showing liabilities £8,600 against assets valued at £10,065. The debtor, therefore did not admit insolvency, and he attributed his present position to the war, in consequence of which his Russian operations came to an end, and his English business had practically ceased. The failure was further explained by the debtor's inability to recover moneys due to him. In the absence of any offer, Mr. R F. W. Fincham, chartered accountant (Fincham, Partridge & Co.), was elected trustee to wind up the estate in bankruptcy, assisted by a committee of inspection.

J. G. M. Hilton, electrical engineer, Birmingham.—A second and final dividend of 2s. 2½d. in the £ was payable of March 3rd at the Official Receiver's office, 191, Corporation Street, Birmingham.

James William & Tom Whitaker Tattersall, trading as "Tattersall & Tattersall," electrical engineers, 9, Regent Street, W., and Kimberley Road, Willesden Lane, N.W.—A sitting of the London Bankruptcy Court was held on Tuesday, before Mr. Registrar Linklater, for this public examination. The statement of affairs showed liabilities £3,760, and assets valued at £481. In the course of their evidence the debtors stated that in August, 1912, with about £150 capital, equally subscribed, they commenced trading in partnership as motor engineers at 9, Regent Street, their business consisting of the purchase and sale of carburetters. They invented a patent electric lighting and starting equipment for motors cars, and took out patents in Great Britain, France, and Italy. The premises at Kimberley Road were taken in November, 1913, for the purpose of manufacturing the electric starters, and, according to their calculations, they were going to make a profit of £10,000 per annum. Their output before the war was about 40 a month, but since August the trading had practically ceased. At the commencement of the war they placed their position before their principal creditors, who stated that they would not require payment of their accounts for six months, and in some cases advanced moneys for the payment of wages. In January last they again consulted their principal creditors with a view to appointing a trustee, but, the negotiations falling through, they filed their petition in February. The debtors attributed their failure and insolvency entirely to the war. The examination was concluded.

George John Tom Jelley Parfitt, 11, Priory Road, Keynsham, consulting electrical engineer.—A meeting of creditors was held at Bristol on 10th inst. The statement, according to the *Western Daily Press*, showed liabilities £4,482, of which £2,026 will prove for dividend. The assets included 50 £1 ordinary shares in the Revenge Syndicate, 250 £1 ordinary shares, Bristol International Exhibition, Ltd., £710 in debentures of that undertaking, and 1,000 preference and ordinary shares in the Keynsham Electric Light and Power Co., Ltd. The causes of failure were stated to be "losses for goods supplied to and through guarantees given for the Bristol International Exhibition, Ltd., which went into liquidation, and loss of business caused by the war." The Official Receiver said he did not see any likelihood of getting a dividend for the creditors. The Official Receiver remains trustee.

Private Arrangements.—A. J. Gage & P. V. Fright (trading as Pattersons), electrical engineers, 26, Hawley Street, Margate.—The creditors interested herein were called together on 11th inst. at Margate, when a statement of affairs was presented which had been prepared by Mr. J. W. Scarlett, accountant, showing the position as at March 4th last. The statement showed liabilities of £411, of which £218 was due to trade creditors, and £193 to a cash creditor. The assets were estimated to realise £210, from which had to be deducted £16 for preferential claims, leaving net assets of £195, or a deficiency of £216. In answer to questions it was stated that there was no surplus arising from the private estates of the partners. The cash creditor shown on the statement was Mrs. Fright. After a short discussion it was decided to confirm the deed of assignment already executed to Mr. Scarlett, under which it was stated that the estate would be realised. The following are creditors:—

Veritys, Ltd.	£85
Turner, G. H., & Co.	22
Sanitas Electric Co.	15
Metallic Seamless Tube Co.	50
Fright, Mrs.	193

Catalogues and Lists.—Messrs. L. Andrew & Co., 2, Whitworth Street West, Deangate, Manchester.—Wholesale price leaflet of india-rubber gloves and gauntlets.

Mr. Chas. H. Blume, White Buildings, Fitzalan Square, Sheffield.—Descriptive leaflet concerning "Radiolac" heat-radiating insulating enamel, a heavier-bodied medium than the usual insulating varnishes, for the impregnation of electrical windings and similar purposes. "Radiolac" is being manufactured at the firm's works at Mitcham, Surrey.

Messrs. Belco, Ltd., Windsor House, Kingsway, London, W.C.—Illustrated priced leaflets relating to "one part" holders, "Dim-a-lite" turn-down switches, weatherproof "Half-watt" lanterns, and semi-indirect lighting fittings for one-watt and half-watt lamps.

Messrs. Marples & Leach, 26-30, Artillery Lane, London, E.C.—March stock list of new K. & M. type C.C. and A.C. motors, a considerable number of which, ranging from ¼ H.P. to 30 H.P., are held in stock, or on order for stock. Copies of the firm's monthly stock lists will be sent to any address regularly on application.

Messrs. David Brown & Sons (Huddersfield), Ltd., Huddersfield.—136-page illustrated catalogue, giving very exhaustive information respecting their double helical gear and its application as a speed reducer. The D B.S. process and the manufacture of the gearing are described in detail, and many pages are occupied with useful engineering tables and formulæ.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C., have issued their Osram lamp semaphore code advertisement, which appeared in our last issue and attracted a good deal of attention, in the form of a postcard. Numbers of these can be obtained over-printed with the names and addresses of electrical contractors, dealers, and others interested in the sale of the lamps, by making immediate application. The reverse side of the postcard is an order form. The advertisement forms a novel and ingenious piece of electrical publicity work, and should be very telling.

Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.—Folder illustrating the "Simpl." boring tools made by the Allen and Curtiss Co., of America.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—32-page illustrated catalogue (No. 37), giving general specification and conveniently-arranged tables of weights, dimensions, prices and code-words relating to Silvertown dynamos from 75 watts to 66 KW., and motors from ·22 B.H.P. up to 90 H.P.

Advances in Prices.—The Electric and Ordnance Accessories Co., Ltd., announce that, owing to the present situation, and the consequent increase in cost of raw materials and labour, it has been found necessary to advance their prices for motors and dynamos by 5 per cent. Outstanding quotations are subject to immediate acceptance, and the company cannot, in any case, accept orders at the old prices except where such are based on quotations made within a period not exceeding 30 days prior to the placing of the order

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, E., announce that in consequence of the increased cost of manufacture, due to the prevailing conditions, they are compelled to advance their prices of rubber-insulated cables, wires, and flexible cords by 5 per cent., as from March 1st

Book Notices.—*Business Prospects in Russia.* By A. T. Stewart. London: Francis Hodgson. 4d. net.—The author of this pamphlet, according to the preface, was in Russia last year, and while he somewhat discounts the value of his views and figures, he advances them in the hope that they may pave the way for fuller and independent investigation by the reader. The trading power of Russia, the effects of the war upon Russian imports and exports, the controlling influence of German enterprise and German capital, are considered, and statistics are given. The author holds that numerous opportunities for British trade have been lost by reason of our unscientific organisation and apathy, but considers it inopportune to harp upon that subject, and proceeds to discuss the difficult question "What is to be done?" He urges British manufacturers not to wait, but to strike at once. After seven or eight months' war, he says that numerous preliminaries and investigations should be made now. That is what we said many months ago. Surely it is rather late in the day to give such advice. The writer, apparently against his will, is led into considering defects in our own trade policy in comparison with German, and he goes on to write of the need of direct trading by means of proper and effective direct representation, and the necessity for co-operative action amongst our manufacturers. A great variety of other points are touched upon, but all with great brevity, such as the need for revising our credit system, the question of trading licences, joint stock companies, the importance of Russian fairs, the defects in our Consular service (in Petrograd, he says, we had a Consular staff of four at the outbreak of war, costing £1,820 per annum, and Germany had a staff of 17, costing £10,000). There is a brief chapter on engineering trade, and the well-organised German competition in the electrical branch is passingly referred to. The writer says that we must send out energetic men to advertise and create a demand for our products, and samples and models must be exhibited, and catalogues prepared in the language, currency, and measurements of Russia.

"The Theory of Alternating Currents." Vol. I. By A. Russell. London: Cambridge University Press. Price 15s. net.

"Norgé Vinterbilleder" is the name of a book of large collotype views of Norway in winter, which we have received from Messrs. James McMillan & Co., London. An article by Robert Millar, in four languages, describes the attractions of Norway as a winter holiday ground, and the beautiful illustrations bear out his claims. At another time, and under different circumstances, the delights of Norway might well entice one northwards, but during the war the face of every British sportsman will be turned to the east, and the pursuit of pleasure will be unthinkable.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII. No. 244. March 15th, 1915. Price 3s. 6d. This issue contains papers on "Electricity Applied to Mining," by C. P. Sparks; and "Polyphase Commutator Machines and their Application," by N. Shuttleworth.

Russian Electrical Trade.—M. A. A. Kuznetzoff, Professor of the Electrotechnical Institute, has made a report on the relation of the tariffs on raw and finished products of the industry. He shows, with the aid of statistics, that at present the imports of finished electrotechnical goods are less than those made in the country, particularly in connection with apparatus and accessories required for telegraphs and telephones. This is explained by the tariffs being higher for finished goods than for the raw materials. He says that the famous Russian Siemens & Halske Co., founded with German capital, and managed by Germans, being hitherto without competitors in Russia, made Morse telegraphic apparatus at £69 each, whereas now this apparatus can be had from Russian factories at £13. This is how the Germans made money out of the Russian Government. The position with regard to the production of dynamos, motors, measuring apparatus and electric lamps, has become very unsatisfactory, but it is expected that it will soon improve, and that Russia not long hence will not require to import these goods from the "cultured" Germans. He says, further, that it is not enough to raise the tariffs in order to ensure the development of the electrotechnical industry in Russia; it must be carried on with Russian money, and by Russians. Further facilities for credit must be given, and geological research must be stimulated for the discovery of such necessary metals as tungsten and thorium. He observes that in Russia, in Transbaikal, there are deposits of thorium, and in Eastern Siberia of wolfram, but neither is exploited. Both metals were imported from Germany.

Aluminium Production in France.—The municipal authorities of Marseilles have placed under sequestration the Bauxites Co., whose headquarters are in that city, and whose capital amounts to several millions of francs. At the end of June last this company was French, but about that period it became German, following on the acquisition of the whole of its shares by the Aluminium Co., of Neuhausen, Westphalia.

Trade Announcements.—Messrs. Clough, Smith and Co., Ltd, have taken over new premises at Regent House, Kingsway, W.C., to which address all communications should be sent on and after the 24th inst. Telegraphic address: "Clufmit Westcent London;" telephone number, "Gerrard 3288."

It is announced that as Mr. Fisher is serving in H.M. Forces, the business of Messrs. Fisher & Hann, electricians, of Egerton Road and 23, St. Leonards Road, Bexhill-on-Sea, is being closed.

Army Contracts Department.—The address of the Director of Army Contracts has been changed to Imperial House, Tothill Street, Westminster. Further particulars are given in our advertisement pages.

Dissolutions and Liquidations.—Schleyder's Economic Steam Furnace (Continental), Ltd.—A meeting will be held at 33, Craven House, Kingsway, W.C., on April 20th, to hear an account of the winding up from the liquidator, Mr. R. W. Ednie.

Powers & Draycott, ironmongers, cycle dealers and electrical engineers, Bedwell Lane, Four Oaks, Sutton Coldfield.—Messrs. F. H. Powers and C. R. L. Draycott have dissolved partnership. Mr. Powers will attend to debts.

Electric Meters in Russia.—The principal types of electrical meters approved by the Russian Office of Weights and Measures are of German production. There is, however, no particular shortage of these, as, according to a correspondent, there has been a large decline in the number of users of current. An effort is to be made to induce the Office of Weights and Measures to approve meters made in the countries of friendly and neutral Powers, such as Switzerland, France, England, &c.

LIGHTING and POWER NOTES.

Australia.—The Cooma (N.S.W.) Municipal Council has decided to engage an expert to report upon electric lighting schemes for the municipality.

Aylesbury.—Motor Supply.—The U.D.C. has informed the British Thomson-Houston Co. that it is willing to recommend the company's motors to intending hirers and purchasers on terms contained in the tender, and to find accommodation at the works for a supply of motors for exhibition purposes on the company's responsibility. An estimate is to be prepared for installing the E.L. at the Town Hall.

Ballymena.—Workhouse Lighting, &c.—The L.G.B. has sanctioned a loan of £3,300 for the purposes of heating and lighting the workhouse by electricity.

Barnsley.—Restricted Lighting.—The Electricity Committee has made arrangement for restricting the public lighting, in order to comply with the regulations of the military authorities.

Bath.—The Electric Lighting Committee has decided to make application to the T.C. for £2,000 in respect of an expected deficit in the financial year 1914-15.

Bingley.—Proposed Loan.—The U.D.C. proposes to apply to the L.G.B. for sanction to borrow £1,000 for electricity purposes.

Blackburn.—New Power Station.—The new Government order discouraging local loans until the close of the war will, for the time being, put an end to the proposal to begin the erection of new electricity works at Whitebirk.

Bristol.—Restricted Lighting.—The T.C. has been informed that a further reduction of street lighting is necessary; lights on the water front are to be masked, and all lights not extinguished must be darkened at the top and upper portion of the globe; sky signs, facias and outside lighting must be discontinued.

Broadstairs.—Public Lighting.—The Isle of Thanet Tramway and Lighting Co. has offered to light the streets in which its cables are laid, at £2 17s. 6d. per lamp per annum on a five years' contract. The capital cost of providing 170 standards, based on present prices, would be £637 10s. The U.D.C. has referred the matter to the Lighting Committee for consideration.

Buckhurst Hill (Essex).—Prov. Order.—The U.D.C. has decided to consent to the application of the County of London Electric Supply Co. for a prov. order for electric supply for the district.

Burnley.—Reduced Discounts.—In consequence of the condition of the town's finances the rate of discount to electricity consumers is to be reduced from 10 to 5 per cent.

Canada.—The East End power station now being built by the Dominion Power and Transmission Co., of Hamilton, is situated on the Lake Ontario water-front at the extreme north-east end of the city of Hamilton. The company's present principal source of power is the hydro-electric generating plant at Power Glen, near St. Catharines, and about 35 miles distant from Hamilton. At this development there is a head of 265 ft., the water used coming from Lake Erie, *viâ* the Welland Canal. Power is supplied to subsidiary companies in Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville and Hamilton districts, but by far the largest portion goes to the city of Hamilton. Three separate transmission lines, at 45,000 volts, connect the Power Glen plant with the main switching station at Bartonville. The new steam plant will be free from the ice troubles to which all hydro-electric plants are subject in cold weather. The plant has been designed for a capacity of 75,000 K.V.A. The turbine-generator units are each of 12,500 K.V.A. capacity, operating at 6,600 volts, three-phase, 66⅔ cycles, 2,000 R.P.M., and are of the Westinghouse-Parsons-Curtis type, equipped with surface condensers and Le Blanc air pumps.—*Canadian Engineer.*

Belfast.—The Harbour Trust reports that during the year a 120-ton electric derrick crane has been installed at the Alexandra wharf, also four 5-ton electric gantry cranes for the coal trade.

British East Africa.—The increased and urgent demand for electricity has caused the Nairobi Electric Power and Lighting Co. to temporarily suspend the street lighting; a new generator is on order, and expected to be available in two months' time.

Chatham.—Increased Tariff.—In consequence of the great increase in the cost of coal and other materials, the Kent Electric Power Co. announces that from April 1st the price of current will be increased by 20 per cent.

Colwyn Bay.—L.G.B. Inquiry.—An inquiry was held last week on the application of the U.D.C. to borrow £35,000 for the erection of a refuse destructor and generating station adjoining the L. & N.W. Railway at Bronyant. There was no opposition.

Dublin.—Increased Tariffs.—The City Electricity Committee having been reassured on the matter of coal supply, proposes to abandon the suggested increase in charges of 1d. and ½d. per unit, and to revert to the original proposal of an increase of ½d. and ¼d. for lighting and power respectively.

Ealing.—Electric Vehicle Tariff.—The Electricity Committee has fixed the following tariff for the charging of electrical vehicles at the electricity works:—1½d. per unit plus 2s. 6d. for each connected for an off-peak supply.

Edinburgh.—Owing to the increasing demand for electric light, the Electricity Committee recommends the T.C. to proceed with the necessary extensions of supply mains to Juniper Green, Corstorphine and Liberton.

Epsom.—The electrical engineer's statement for the past quarter shows decreases, as compared with the corresponding period last year, of 41,489 units in the quantity generated, 12,700 units in the quantity sold for public lighting, and 34,934 in the quantity sold for private lighting, while the units used on works show an increase of 2,620.

Glasgow.—The B. of T. has consented to the construction of condensing water inlets, &c., in the River Clyde, near Dalmarnock Bridge, at the new generating station. In connection with the new works it is recommended that during the next two years Mr. Lackie should be authorised to obtain advice from a consulting electrical engineer regarding the installation of machinery and plant to be put down in the new station.

Holme (Yorks.).—E.L. Scheme.—A canvass of the village is to be made on the proposed supply of electricity, the scheme being to utilise an old water mill.

Huntingdon.—Refuse Destructor.—The T.C. has instructed the borough surveyor to inspect a refuse destructor in another town of similar size, with a view to one being installed.

Itchin.—Prov. Order.—The Southampton T.C. has informed the U.D.C. that it has applied to the B. of T. to dispense with the Council's consent to an application for a prov. order for E.L.

Kingstown.—E.L. Scheme.—The U.D.C. has now decided to formulate an electric lighting scheme, and application is to be made to the L.G.B. for a loan for this purpose.

Kingston.—Price Increase.—The T.C. has decided, on the recommendation of the Lighting Committee, to make an all-round increase in the charges for lighting of 10 per cent., as expressed in fractions of a penny, except as regards special agreements, which will be dealt with as they expire. The chairman of the Lighting Committee stated that it would be better to wait until the Diesel oil engines had been working for a year, before forming any opinion as to their suitability. It would then be for the Council to come to some decision as to continuing the works or instituting a different system. If at the end of the year the balance-sheet was unsatisfactory, it would, no doubt, be possible to get someone to take the undertaking off the Council's hands.

Leicester.—Year's Working.—The accounts of the electricity department for the past year showed that the excess of receipts over working expenses was £22,712, and after paying interest and sinking fund charges there was a net surplus of £7,643, which is to be carried to the district fund for the relief of the rates.

Leigh.—Plant Extensions.—The proposal of the Electricity Committee to duplicate certain plant at an estimated cost of £10,000 has been referred back by the T.C. for further consideration.

The T.C. has decided that from April 1st electricity for lighting places of amusement be charged for at the flat rate of 3½d. per unit; and for power purposes and outside lighting 2½d. per unit; to shopkeepers, outside lighting, 2½d. per unit, these charges to be subject to discount.

London.—Hackney.—The T.C. has decided to adopt the recommendations of the Sub-Committee that the annual stock taking at the electricity works be carried out by independent stock takers, so that in future the accounts of the undertaking may be presented before the summer recess; also that professional accountants shall be engaged to conduct each year a commercial audit of the accounts of the electricity department.

Bermondsey.—The Electricity and Street Lighting Committee reports that it has been necessary to shut down the No. 2 condenser (the first evaporative condenser) for a short time as there was a leak in the exhaust pipe running between the coils of the condenser. The exhaust pipe, the Committee states, is made of ¼-in. plate mild steel, and is being continually corroded away. Another leak developed on the 1st inst. In the latest evaporative condenser the exhaust pipe is cast-iron and shows no signs of corrosion. It will cost about £180 to replace the mild steel exhaust pipe with a cast-iron one, and it will probably have to be replaced during the next financial year. The condenser cost £3,295, and £1,112 has been paid off the loan.

Hammersmith.—The Cartage and Works Joint Committee recommends that all regular employés other than members of the staff be granted a temporary weekly increase of 7½ per cent. upon their wages, provided that in no case shall the wages amount to more than 35s. per week. The Electricity Committee recommends, in addition, that regular employés receiving 35s. to 42s. 6d. a week shall be paid a temporary increase in wages of 2s. per week.

Luton.—The T.C. is recommended to give a supply of current to the factory of G. Kent, Ltd., by means of an overhead line, provided the firm pays a proportion of the cost. The electrical engineer is to report on the question of lighting the streets by electricity.

Manchester.—The Electricity Committee has decided to make a strong effort to get the Treasury and the L.G.B. to remove the ban which makes it impossible to proceed with the big power station at Barton. The scheme involves an initial outlay just short of £550,000, and sanction has been given for the purchase of the land and the erection of the works. It was hoped to have a portion of the new station at work by the autumn of 1917.

The Special Committee of the T.C. has recommended that in order to meet the increased cost of living, a war bonus of 2s. per week be paid to Corporation workmen receiving 40s. per week or under.

Normanton.—E.L. Scheme.—The U.D.C. has decided in connection with the proposed electric lighting order to inform the B. of T. that it favours an oil-engine plant, but does not wish this to be binding, should another system be found more advantageous.

Rhyl.—Camp Supply.—The U.D.C. has decided to give a supply of energy to the Kinmel Military Camp at the same rate as it supplies other large consumers, plus ½d. per unit.

South Africa.—The Worcester (Cape Province) Municipality is about to install its own electric lighting scheme. The system is three-wire, direct-current, at 440 volts, and the plant will consist of water turbines (Pelton wheels) and a Diesel engine. The scheme is estimated to cost £15,000; the consulting engineer is Prof. Bohle, of the South African College.

A temporary breakdown recently occurred in the Johannesburg supply, a fault occurring in a main cable tunnel, where the bitumen cable insulation began to burn.

The scheme for extending the supply of electrical energy in Port Elizabeth is now being carried out.

A complete new plant has been ordered which will consist of two 1,000-kw. turbo-alternator sets, with high-pressure steam turbines by Messrs. Fraser & Chalmers, alternators by Messrs. Dick, Kerr and Co., and surface condensing plants. A 500-kw. motor-converter set has been ordered from Messrs. Bruce Peebles & Co., and the B.T.H. Co. will supply the switchgear. The boiler plant is being extended by the addition of two units, and a plant to mechanically handle the coal and ashes is being installed. Messrs. Fraser & Chalmers are the principal contractors for the generating plant, and will be responsible for the installation, which will be of British manufacture throughout.—*South African Mining Journal.*

Swinton and Pendlebury.—Public Lighting.—The U.D.C. has instituted a charge for electricity for public lighting of 1½d. per unit.

Taunton.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £1,175 for electricity purposes, mains, services and transformers, and for sanction to transfer to the mains account £550, being the surplus of a previous loan.

Tenby.—E.L. Scheme.—The B. of T. has informed the T.C. that it would not consent to give the Council authority to transfer its powers to a company; also, that a clause would be introduced into every order passed during the present session that no capital should be expended until the war was over. The Council decided to proceed with the application for the order.

Truro.—E.L. Scheme.—The T.C. has been informed by the L.G.B. that the time does not appear opportune for the raising of a loan or for the installation of a new E.L. scheme. The question was referred to the E.L. Committee.

Walkden.—In connection with the projected sinking of a new Arley mine, which will be half a mile in depth, the Earl of Ellesmere is having an extensive generating station built at his Mosley Common Collieries, near Walkden. A generating station has also been provided at his Ashton Field Colliery.

Wanstead.—Prov. Order.—The U.D.C. has deferred, until the new Council is elected, the question of consenting to the prov. order for E.L., which is being applied for by the County of London Electric Supply Co.

Wednesfield.—The Midland Electric Corporation for Power Distribution, Ltd., has applied to the B. of T. for consent to use overhead lines at Wednesfield for the transmission of energy at a pressure of 7,000 volts

Wells (Somerset).—Prov. Order.—The T.C. has been asked by the B. of T. for its observations on the application of the Mid-Somerset E.L. Supply Co. for a prov. order to supply electricity to the district, and has informed the Board, that it considers the headquarters of the company should be in the eastern or coalfield end of the area; that the prices are far above the ordinary and the lighting area is too restricted. For these reasons the Corporation should have the power of purchase at as early a date as possible, because by reason of proximity to the Mendip coalfield it might be able to produce at a cheaper rate.

Winchester.—The Electricity Committee reported that the output for the past year was 129,900 units, as against 116,982 in the previous year, an increase of 11 per cent.

Woodford.—Prov. Order.—The U.D.C. has decided, by 5 votes to 3, not to consent to the granting of a prov. order for E.L. for the district to the County of London Electric Supply Co., Ltd. The reason for the opposition was that eight present members of the Council are not seeking re-election this year, and that, under the circumstances, it was not fair to bind the new Council.

Yorkshire Power Bill.—The Barnsley, Bradford, Halifax, Huddersfield, Rotherham, Sheffield, and Wakefield Councils have formed a Joint Committee to oppose the Yorkshire Electric Power Bill, 1915.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System Discontinued. — The Corporation Tramways Committee has now recommended the T.C. to discontinue the P.A.Y.E. system of collecting fares. The Committee considers that having regard to the nature and extent of the opposition to the system on the routes where it has been in operation, it is not expedient to continue it any longer.

Ashton-under-Lyne. — Proposed Tramway Purchase.—The T.C. has decided on the recommendation of the Tramways Committee to take steps to purchase so much of the undertaking of the Oldham, Ashton and Hyde Electric Tramways Co. as is within the borough, and for acquiring, by lease or otherwise, the tramway between the areas of Waterloo and Bardsley if satisfactory terms can be arranged with the respective Parish Councils. The proposed purchase will be possible within six months after August 7th, 1917.

Australia.—The returns of the N.S.W. railways and tramways for the quarter ended December 31st last show a falling off in receipts in the former case, while in the latter there was an increase in earnings of £15,528, a decrease in expenditure of £26,064, in passengers carried, in 7,700,000, and in mileage, of 535,000, as compared with the corresponding quarter of the previous year.

The Victorian Railway Commissioners have been informed that the first of the six 10,000-kw. Parsons units for the Newport power house has been successfully tested. Work is in progress on the boiler house and a quantity of material has arrived.

The Hawthorne (Vic.) Tramway Trust is obtaining a car body built entirely of Australian timber as an experiment.

An association of local bodies is being convened to consider a general tramway scheme for Northcote, which might link up with lines in Brunswick, Coburg and Essendon.

Belfast.—A company is seeking to secure the interest of the directors of the old tramway company in order to run a new service from the Square, Warrenpoint, to the Quay, Rostrevor, by means of electricity.

Bolton.—In connection with the relaying of certain track, it has been reported that it will be advisable to relay a length of 25 yards of the South Lancashire Co.'s tramways. The latter company has agreed to supply the material if Bolton will do the work, and the Bolton Tramways Committee has decided to do this.

Chile.— Electric Railway.— A 2,400-volt direct-current line is being built between the Tofo mines and the port of Cruz Grande. The average gradient on the 15 miles of track is 1 in 33, and the total descent 2,000 ft. From a main power station containing three 3,500-k.v.a. and one 300 k.v.a. Curtis turbo-sets, energy will be transmitted at 22,000 volts to a sub-station containing two three-unit 1,000-kw., 2 400-volt synchronous motor-generators. The line is to be used for taking iron ore to the coast, and the three 110-ton locomotives first installed will be equipped for regenerative control, feeding power back into the supply system on down grades.

China.—Railless Traction.—After being in use for only a few weeks, the system of railless cars, which was started in Shanghai by the Shanghai Tramway Co., has, it is announced, had to be suspended for the time being. The only road traversed by the vehicles was the Fekien Road, and when everything was promising well, it was found that the road foundations were in such a weak condition as to be unable to stand the weight of the car. The only way for the service to be re-started is for the road to be concreted, and it is hoped that in due course the thoroughfare will be rendered suitable for the new traffic.

Continental Notes.—Italy.—In consequence of the inconvenience caused by the electric service in the Giovi tunnel, it has, says the *Revista Tecnica d'Elettricità*, been decided to resume the old steam service. This appears to be due to the unsuitable rheostats of the new 330 type of locomotive. Several of these locomotives have been made without being properly tested. Further trouble has arisen from the supply of energy from different sources, which apparently have somewhat different frequencies.

The Italian Public Works Department has granted an application for a subsidised concession for an electric tramway between Asola, Montanara and Cremona.

Ealing.—The T.C. has decided to request the London United Tramways Co. to remove all the unlighted centre tramway poles, 51 in number, and four centre poles carrying arc lights; refuges to an approved plan are to be constructed at the bases of the poles retained, the Corporation agreeing to contribute £1,000 towards the cost of the removal of the poles and the construction of the refuges, the liability in connection with the posts carrying arc lamps, and the proposed refuges, to rest with the company.

Glasgow.—The Tramways Committee recommends that the agreement with the Paisley District Tramways Co. for the running of the T.C.'s tramway cars from Hawkhead Road to Paisley Cross be renewed, and that as a basis of renewal an allowance of 15 per cent. on the present rate per mile be asked to meet working charges.

Huddersfield.—Several extensions and improvements to the tramway system are contemplated. The Kirkgate section is to be re-laid, and on the Egerton section the line is to be doubled from the top of Cemetery Road to Thornhill Road. The Longwood extension is also under consideration.

Hull.—The Tramways Committee has decided to give the drivers and conductors earning less than 30s. per week an advance of 3s., and those earning more than 30s. an advance of 2s. This will also apply to inspectors. The engineers and electricians will also be given an increase, as the Corporation is pledged to recognise the standard rate. These concessions will cost the department about £9,000 a year.

Ilford.—Tramway Fares.—The Council has decided to levy a 1d. rate to meet the deficiency on the working of the tramways. Mr. L. E. Harvey, the tramway manager, has reported on the question of fares, against the ½d. fare and in agreement with the universal 1d. fare which has proved so successful in South Shields. If the 1d. fare covers standing charges, plus a margin for working costs, it does not matter how far, within reason, the passenger is carried. Mr. Harvey made certain recommendations in regard to workmen's 1d. return tickets. The Council has decided to allow the fares to remain as at present.

London.—The L.C.C. has decided to grant an increase of 3s. a week, or 6d. a day, as from March 1st, to all officers and employés of the Council whose wages are less than 30s. per week.

Luton.—Income-Tax Assessment.—The T.C. has been recommended to appeal against income-tax assessments on "rent of tramways," amounting to £951, for the years 1912-15.

Lowestoft.—The engineer has been instructed to proceed with repairs to the tramway track between Church Road and Pakefield, at a cost of £300.

Manchester.—The Corporation has decided to offer a war bonus of 2s. per week to employés earning less than 40s. per week. The local secretary to the Tramway and Vehicle Workers' Union has been instructed to press for the 15 per cent. advance previously applied for.

South Lancs.—Owing to recruiting, the number of men carried on the South Lancashire Co.'s system in the early morning and afternoon is showing a material shrinkage. The company's system runs through a colliery area which has supplied over 12,000 colliery workers to the new Armies.

TELEGRAPH and TELEPHONE NOTES.

Argentine.—For some time the United River Plate Telephone Co. had been suffering from the destruction of their subterranean lines, and eventually the police discovered two ex-employés of the company cutting one of the cables. They stated that they did it out of revenge for having been dismissed. The losses suffered by the company amount to about $30,000. It appears that there was a gang of men engaged in doing the damage.—*Review of the River Plate.*

Provision for Telephones.—The Postmaster-General has written to the principal Architectural Associations to call attention to the importance of making adequate arrangements in the plans of large buildings for the installation at a later stage of telephone equipment. Provision should be made, as a minimum, for one 3-in. pipe from the public footway to the basement or ground floor and for cables to the other floors. It is also desirable that there should be a ready means of leading wires to the various rooms on the different floors.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—April 6th. U.D.C. Motor-generators or converters, one H.T. switchboard and L.T. panels, and one H.T. feeder pillar. See "Official Notices" to-day.

Australia. — Sydney. — March 23rd. One 150-ton electric revolving floating crane for Naval Dockyard, Sydney. Particulars from the Board of Trade Commercial Intelligence Branch, London.

Ayr.—The Corporation surveyor is to invite tenders for the extension of the engine-room at the electricity station for new plant.

Bray.—April 6th. U.D.C. Stores for electric light works. See "Official Notices" to-day.

Bridgend.—April 8th. U.D.C. 400-kw. steam alternator. See "Official Notices" to-day.

Burnley.—March 22nd. Electricians' work for the B. of G. Forms, &c., from Mr. J. S. Horn, Clerk, Union Offices.

Carlisle.—March 31st. Corporation. Twelve months' supply of jointing materials, oils and general stores. Forms, &c. from City Electrical Engineer, Victoria Viaduct.

Dundalk. — March 23rd. U.D.C. Twelve months' supply of stores for the Electricity Department. See "Official Notices" March 5th.

Dundee.—March 29th. The Corporation Electricity Department invites tenders for stores.

Edinburgh.—March 29th. Corporation. Three, six or twelve months' supply of insulated cables, arc lamp carbons, fuse boxes, meters, &c., for the Electricity Supply Department. Forms of tender (10s.) from the Electrical Engineer's office, Dewar Place.

April 12th. Corporation. Water-tube boilers for Portobello Supply Station. See "Official Notices" to-day.

Glasgow.—The Town Clerk (Mr. John Lindsay) has been authorised by the Electricity Department to advertise for tenders for stores (with the exception of coal) for one year from May 31st.

Greece.—April 15th to 28th. Greek Ministry of Communications. Supply and installation of (1) a central exchange and telephone system at Salonica, (2) a central exchange at Athens, (3) telephonic apparatus and accessories. Only firms who have carried out actual working installations in towns of 100,000 inhabitants may tender. Deposit £400. Local representation. Particulars in French can be seen at Board of Trade Commercial Intelligence Department in London. Ministère des Communications, Direction des Postes, Télégraphes et Téléphones, Athens.

Halifax. — March 26th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, 4, Carleton Street.

Hove. — March 26th. Corporation. One 500-kw. mixed-pressure steam turbine, complete with D.C. 230/285-volt generator and surface condensing plant; also a battery of 115 accumulators. See "Official Notices" March 5th.

Hull.—March 20th. Corporation. Six or 12 months' supply of coal for the Tramways Committee. Forms, &c., City Engineer's office.

Kirkcaldy.—March 22nd. Corporation. Twelve months' supply of brass castings, pitch, iron castings, &c., for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer.

Limerick. — March 26th. Corporation. Engine-room stores, &c. Forms of tender from Mr. E. B. Thornhill, Borough Electrical Engineer, Frederick Street.

London.—The L.C.C. is recommended to invite tenders from selected firms for the supply of an electric lighting main in connection with the lighting of the refuges on the Victoria Embankment.

March 31st. L.C.C. Installation, 218 wiring points, 265 lighting points, at Derington Road Elementary School, Lower Tooting, S.W. See "Official Notices" to-day.

Manchester.—March 23rd. Corporation. One 650-kw. rotary converter and static transformer, for the Electricity Committee. Forms from Mr. F. E. Hughes, Secretary, Electricity Department.

New Zealand.—Wellington.—April 30th. Supply of a three-unit exciter set, and 1,600-kw. generator for the Lake Coleridge Hydro-electric scheme. Specifications from the Public Works Office, Wellington.

Nottingham. — March 22nd. Corporation. Twelve months' supply of electrical sundries for the Tramways Committee. Forms, &c. (5s.), from Mr. J. Aldworth, General Manager, Beastmarket Hill.

Rosslynlee.—Midlothian and Peebles District Asylum, Rosslynlee, invite offers for supplying electric fittings, &c., for six months. The Clerk, 19, Heriot Row, Edinburgh.

Spain. — The municipal authorities of Babilafuente (province of Salamanca) have lately invited tenders for the concession for the electric lighting of the town.

Swinton and Pendlebury.—March 19th. U.D.C. Cables, joint-boxes, bitumen and joint-box compound. See "Official Notices" March 5th.

Tenders have been invited for the installation of a storage battery at the refuse-destructor works, and for mains extensions.

Walthamstow.—March 24th. U.D.C. E.H.T. and L.T. switchgear and cables. See "Official Notices" March 12th.

CLOSED.

Ayr.—The Corporation has accepted the tender, amounting to £9,624, of the Macintosh Cable Co., Ltd., for cables.

Blackburn.—Messrs. Chamberlain & Hookham, Ltd., have received the contract from Blackburn for A.C. and D.C. meters for the next 12 months. The same firm's tender has also been accepted by Whitehaven for meters for the ensuing year.

The Corporation Electricity and Tramways Department has placed a contract with Messrs. J. H. Tucker & Co. for ironclad switches for the next 12 months.

Colchester. — The T.C. has accepted the following tenders for yearly supplies to the Tramways Department:—

Lighting fittings.—Siemens Bros., Ltd.; Joslins, Ltd.
Electrical equipments for tramcars.—G. W. Allsop; P. R. Jackson and Co.; Le Carbone.
Overhead equipment.—Brecknell, Munro & Rogers; Andrew & Co.
Rubber and fibre.—Andrew & Co.; B I. & Helsby Cables, Ltd.
Car fittings and castings.—Stanford & Co.
Car fittings.—Malleable Steel Castings Co.; Tempered Spring Co., Ltd. Equipment & Engineering Co., Ltd.
Oils, grease, &c.—Joslins, Ltd.

Glasgow.—The T.C. Tramways Committee on Works and Stores has accepted the following tenders:—

Crane for Kinning Park sub-station.—Herbert Morris, Ltd.
Stoneware ducts for cables.—Albion Clay Co., Ltd.

London.—Hammersmith.—The Electricity Committee has authorised the placing of the following order for coal for the Electricity Department:—

Harrisons (London).—Four barges (80 to 100 tons) of Yorkshire nutty, at 24s. per ton.

The undermentioned tenders have been received for the annual contracts for the Electricity Department:—

Box Frames, Covers, Boxes, &c.

Johnson & Phillips, Ltd. (recommended)		£377
W. Lucy & Co., Ltd.		415
Henley's Telegraph Works Co., Ltd.		472
B.I. & Helsby Cables, Ltd.		490
Callender's Cable & Construction Co., Ltd.		555
Sykes & Sugden, Ltd.		575
Siemens Bros. & Co., Ltd.		614
W. T. Glover & Co., Ltd.		1,461

Electrical Goods (Accessories).

General Electric Co. (recommended)		£25
Bromell's Patents Co., Ltd.		26
British Thomson-Houston Co., Ltd.		27
Edison & Swan U.E.L. Co.		29
A. S. Goodwin		30

Insulated Wires.

General Electric Co., Ltd. (recommended)		£125
A. S. Goodwin		137
B I. & Helsby Cables, Ltd.		164
I.R., G.P. & Telegraph Works		166

Cables.

Pirelli, Ltd.		£115
General Electric Co., Ltd. (recommended)		116
Liverpool Electric Cable Co., Ltd.		125
A. S. Goodwin		129
C. Macintosh & Co., Ltd.		138
Edison & Swan United Electric Light Co.		143
I. Frankenburg & Sons		149
Johnson & Phillips		154
W. T. Henley's Telegraph Works, Ltd.		155
Siemens Bros & Co., Ltd.		156
B.I. & Helsby Cables, Ltd.		156
I.R., G.P. & Telegraph Works		157
J. Petesen		157
W. T. Glover & Co., Ltd.		158

Tenders were received for prepayment meters from the British Thomson-Houston Co., Ltd.; Messrs. Ferranti, Ltd.; Messrs. Landis and Gyr, Ltd.; and the B.I. & Helsby Cables, Ltd. The tender of Messrs. Ferranti, Ltd., is recommended.

The Electricity Committee recommends the Council to authorise the purchase of a further stock of coal for use at the electricity works up to a maximum of 3,000 tons.

KENSINGTON.—The Guardians have been recommended to accept the tender of the General Electric Co., Ltd., at £38, for six months' supply of electric lamps. Other tenderers were :—

Pryke & Palmer		£45
London & Rugby	(irregular)	31
"Z" Electric Lamp Mfg. Co., Ltd.	(irregular)	42
Wm. Hunteman		49
Siemens Bros. Dynamo Works, Ltd.	(irregular)	41
Watlington & Co., Ltd.	(five items only, irregular)	31
Imperial United Lamp Co., Ltd.	(five items only)	30
Crypselo, Ltd.	(four items only, irregular)	31
Pope's Electric Lamp Co., Ltd.	(five items only)	30
Brimsdown Lamp Works, Ltd.	(five items only)	32
Veritys, Ltd.	(four items only)	31

BERMONDSEY.—The B.C. has accepted tenders for annual supplies from the following :—

Meters and time switches.—Chamberlain & Hookham, Ltd.
Meters, cut-outs, fuses, &c.—General Electric Co., Ltd.
Meter boards.—Ferranti, Ltd.
Cable.—Chas. Macintosh & Co., Ltd.; General Electric Co., Ltd.
Insulating box compound.—Dussek Bitumen Co.
Carbons and brushes.—Morgan Crucible Co., Ltd.
Conduits.—Thomas Wragg & Sons, Ltd.
Steel frames, covers and joint-boxes.—Sykes & Sugden.

ST. MARYLEBONE.—The Electricity Committee recommends the acceptance of the following tenders for annual contracts :—

Flexible cords, fuse wires, &c.—Pirelli, Ltd.; British Electrical Mfg. Co.; London Electric Wire Co.; B.I. & Helsby Cables, Ltd.
Underground cables.—Pirelli, Ltd.
House cables, box compounds and insulation.—L. Andrew & Co.; R. Blackwell & Co.; British Electrical Mfg. Co.; B.I. & Helsby Cables, Ltd.; Dussek Bitumen Co.; J. North Hardy; J. G. Ingram & Sons; North British Rubber Co.; Pirelli, Ltd.

The Committee recommends that the tender of Messrs. Chamberlain & Hookham (agents, Messrs. Venner) be accepted for the supply of 1,000 meters, as required, on the same terms as last year, plus 7½ per cent., owing to the increased cost of materials and wages; also that the offer of the Tudor Accumulator Co. for the supervision of their batteries, at £85 per annum, be accepted.

Lowestoft.—The offer of Messrs. Rowlands & Co. to supply one dozen gear wheels at £3 6s. each has been accepted by the Tramways Committee.

Middlesbrough.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of Wotan and Tantalum lamps for the ensuing 12 months.

Sevenoaks.—The U.D.C. has accepted the tender of Messrs. L. H. Russell & Co. for installing the electric light over the interior of the swimming baths.

Southampton.—The T.C. has agreed to extend for a further period of 12 months the contracts of the following firms for supplies to the Electricity Department :—

Doulton & Co.—Pipes.
B.T.H. Co.—Meters.
W. Rickard, Ltd.—V.B. cable (six months).

The following offers have been accepted for supplies of coal :—

A. Usher & Co.—500 tons Cannock old coppice, 21s. 9d. per ton.
Cory Bros. & Co.—500 tons Pinxton slack, 21s. per ton.
Bradbury, Son & Co., Ltd.—250 tons Tamworth beans, 18s. 4d. per ton.

South Africa.—SOUTH AFRICAN RAILWAYS.—The tender of the S.A. General Electric Co. has been accepted for the supply of electric incandescent lamps.—*S.A. Mining Journal.*

St. Albans.—The tender of Messrs. Giffen Bros. has been accepted by the Guardians for wiring the Infirmary for £16 10s., and the Board-room block for £31 10s.

Wakefield.—Yorkshire (West Riding) Electric Tramways Co., Ltd., has placed a contract for single-phase house service meters, for a period of two years from March 1st, with the Electrical Apparatus Co., Ltd.

NOTES ON COAL STORAGE.

[COMMUNICATED.]

THE great increase in the size of central stations, and hence in their rate of fuel consumption; the importance of the service which they render as a "public utility," which must be maintained continuously; the high normal price of coal, and the readiness with which quotations soar upwards on the slightest pretext—all these factors make the problem of coal storage one of special interest to every central-station engineer. The problem is of equal interest to colliery engineers. From their opposite standpoints, both producer and user wish to maintain a stock covering emergency demands and delay in delivery, preventing as far as possible interrupted supply and broken contracts during periods of labour trouble, and taking advantage of market or seasonal fluctuations in price.

Seeing that 1,000 tons a week is now quite a commonplace consumption for a central station, and 1,000 or 1,500 tons a day is not unknown in large stations in the States, it is clear that the storage of 12, 10 or even 6 weeks' coal supply is no small matter. Storage on the largest scale has been practised in America; indeed, it is estimated that storage capacity is available for 10 to 12 per cent. or more of the annual coal production in the States. Some of the individual stores are very large, for instance, the Lehigh Coal and Railway Co. has storage for some 1¾ million tons, and a number of other companies for over half a million tons apiece.

Unfortunately, coal does not improve with keeping, but opinions differ considerably as to the extent by which it deteriorates, and as to the means most likely to preserve it economically. Having got some thousands or tens of thousands of tons of coal, preferably at a time when the market price is down, what is the best means of preserving the fuel? Three methods of storage at least are available. The coal may be piled in stacks, in the open or under cover; or it may be put in bunkers; or it may be placed in tanks which are then filled with water. Bunker storage is limited by considerations of capital cost to relatively small amounts of coal, but is specially convenient for temporary storage, *e.g.*, holding a day or two's supply for the washeries of a colliery or holding fuel on its way (through the bunkers) to a boiler installation. The cost of a tank store is less than that of an equal over-ground bunker capacity, and is justified in very much larger sizes by the advantages of wet storage. Ordinary pile storage is the simplest and cheapest system, but it exposes the fuel to "weathering" action, the effect of which is to weaken the coal mechanically, reduce its heating value, and introduce a certain risk of spontaneous combustion.

The effect of atmosphere and weather on coals was examined very thoroughly by Lecrivain, two or three years ago, and was found to consist, in greater or less degree, in all coals, of surface oxidation, causing cracks which gradually extend through the pieces, disintegrating them, and exposing fresh surfaces. A preliminary loss of weight, due to drying and escape of fire-damp (methane), is followed by a gain in weight due to oxidation, and then a further loss due to formation, by decomposition, of volatile hydrocarbons, which escape. Spontaneous ignition generally follows rapidly on the last-named stage.

Lecrivain's tests on French coals showed as much as 30 per cent. loss of gas value (and corresponding reduction in calorific value) in a month, and 50 per cent. reduction in three months in the quantity of ammonia by-products recoverable. These losses are higher than generally experienced, but it is not unusual to find 10 or 20 per cent. of the gas value of a coal lost by air storage, and if such coals be used for boiler firing, proportionate loss in steam-raising value is, of course, experienced. (The "gas value" is about 5 per cent. of the total calorific value.)

Tests conducted recently by the U.S. Navy Department showed that the slack New River coal, which deteriorates not at all under water, loses about 1 per cent. in calorific value during 12 months' exposure to weather; larger grades suffer less loss. Coal in a 120-ton pile on the Isthmus of Panama lost less than 0·4 per cent. in heating value during a year's weathering, and was not disintegrated or otherwise damaged physically. On the other hand, black lignite lost 3·5 per cent. heating value in three months, and 5·3 per cent. in three years in outdoor 3 to 6-ton bins. As might reasonably be expected, the loss in calorific value is several times greater in lignite coal than in hard steam varieties. From average steam coals there occurs soon after mining a loss of gas representing 0·1 to 0·2 per cent. of the total calorific value. The escape of this gas is at least as serious from the explosion risk it introduces as from the standpoint of calorific value. Coal which exhales much gas should be seasoned for a few weeks if possible before stacking.

Moisture and freezing are particularly injurious to coal which has a tendency to cleave, especially if it has begun to do so owing to rough handling and surface oxidation. In severe climates the freezing of exposed piles in winter is a serious consideration, and dynamite has had to be used before now to get coal in winter from open stacks in the States. Alternate dryness and dampness is particularly injurious, hence coal should either be submerged completely or stacked in piles which do not favour the accumulation and

gradual evaporation of moisture. The disintegrating effect of weather is, of course, greatest near the surface of piles. The smaller the coal the less the penetration of weathering, the effects of which are generally most marked in an outer layer 1 or 2 ft. thick.

As shown later, the one or two per cent. loss of calorific value in weathered coal is saved by wet storage, but at the cost of roughly the same indirect loss due to the wetness of the coal as fired. This being so, the chief argument in favour of wet storage is the elimination of fire risk. Experiments conducted last year in Yorkshire show that oxidation of fine coal exposed to the atmosphere may easily proceed fast enough to cause cumulative temperature rise at the rate of $\frac{1}{2}$° F. per diem, assuming that no heat escapes, which is at least approximately true in the centre of a large coal heap to which there may nevertheless be sufficient air access for oxidation to occur. As the temperature rises, the rate of oxidation, and therefore of heating, increases. At about 160 or 170° F. the heat of oxidation is absorbed completely in evaporating moisture. During this period the coal steams freely and its temperature remains constant; thereafter heating is liable to proceed quickly and spontaneous combustion to occur. Under suitable circumstances, easily attainable in large heaps, the presence of moisture may actually accelerate spontaneous heating, moisture evaporated from the parts first oxidised condensing on and thus warming other surfaces.

Dust and smalls naturally heat up more quickly than lump stacks. Warm, moist climates favour rapid oxidation. The presence of pyrites in coal is particularly dangerous, and so is the oily nature of some varieties. The accumulation of heat to any dangerous degree cannot occur in very shallow stacks. In deep stacks special ventilating pipes or ducts are sometimes provided, but in the event of self-heating commencing, these passages may aggravate the danger by gently fanning the incipient flame. From 10 to 20 ft. is considered the limiting desirable depth for dry coal heaps in England and France, whether in the open or under cover. Besides the overheating danger, it is considered that explosible dust pockets are liable to form in deeper piles. In American storage fields, piles up to 80 or 90 ft. in height have been built with anthracite, but bituminous coal is found to be badly crushed and subject to decomposition and overheating risks if piled more than 35 ft. deep.

Big lumps rolling down an open-air stack are apt to form channels round its base which act like the air ducts in a charcoal-burner's heap, and increase the risk of spontaneous combustion, particularly if there is in the centre of the heap a mass of small coal liable to overheating. Fine coal should not be stacked when avoidable. If, as is generally the case in modern central stations, a slack coal is used on chain-grates, the reserve coal stock should either be kept under water (in which case it is wet and messy to stoke), or should be of fairly large grade and crushed as and when required. Since the reserve can be held (particularly under water) for very long periods without serious deterioration, the second alternative is not extravagant, for the more costly lump reserve coal is crushed only once in one or several years, emergencies excepted.

Storage under water, whether fresh or salt, undoubtedly does preserve the calorific value of coal almost indefinitely. It is sometimes said that it renders coal brittle, and no doubt fuel subject to easy cleavage is weakened by long immersion, water seeping into minute cracks and then, by its lubricating action and hydraulic rigidity, facilitating breakage. Freezing has, of course, a bad disintegrating effect on coal containing water in its fissures. On the other hand, the buffer effect of the water in which the coal is stored reduces breakage in dumping and grabbing, so that the net effect as regards breakage is probably rather favourable than otherwise. The chief value of water storage lies, however, in preventing spontaneous combustion, and it is a fortunate though natural coincidence that those coals in which the risk of spontaneous combustion is greatest, are also those which deteriorate most by weathering, and, therefore, benefit most in this direction also by sub-aqueous storage.

The first large under-water coal store was the 10,000-ton tank built by the Western Electric Co. in Chicago 13 years ago. Since then many others have been built for industrial and navy use, but more in the States than in Europe. The general construction resembles a swimming bath (but of uniform depth) spanned by a travelling grab crane and loaded by a travelling tower and shoot, or by grab crane. The reinforced concrete tank in which the Omaha electricity works stores 10,000 tons of coal measures 100 × 116 × 22 ft., and, in addition to the main reinforcement, a number of old rails are sunk flush in the concrete bottom to prevent the grab bucket from injuring the latter by impact or scraping. Since only constructional costs limit the depth to which wet storage tanks may be excavated, it is possible to store safely and indefinitely more coal per acre under water than in dry stacks.

A fact which is often overlooked is that wet storage generally means firing wet coal. Fine coal naturally retains more moisture than larger grades, and with it wet storage is at once most desirable and most messy; with it, the sticking and general messing-up of mechanical stokers is most troublesome when the coal is wet, and with it the loss of heat required to evaporate moisture in the fuel is most serious. Even the ordinary amount of moisture in coal, which is nominally dry, accounts for $\frac{1}{2}$ to 1 per cent. of the calorific value of coal, *i.e.*, for an amount of heat which is of the same order of magnitude as the loss in calorific value of medium-sized hard coal, during some months' weathering. Where water pans are used in the ash pits of a boiler, 3 or 4 per cent. of the heat value of fuel may be absorbed in evaporating moisture therefrom, but this expenditure is considered justified by the compensating advantage of smokeless combustion and increased available heat in the combustion chamber. The same result is not secured, at any rate so efficiently, by using wet coal, for the fresh fuel dries before it becomes incandescent, and the steam liberated escapes without passing through the fire, *i.e.*, without experiencing that dissociation and recombination on which the advantage of wet ash-pans or special steam jets depends. After prolonged immersion, some coals will hold as much as 5 to 15 per cent. additional water, after the longest draining that can reasonably be given. If the calorific value of the fuel be 14,000 B.TH.U. per lb. and the water content be 15 per cent., its evaporation (requiring about 1,000 B.TH.U. per lb. of water) will absorb 1·1 per cent. of the heat value of the coal, and may thus constitute as serious a loss as the loss of calorific value which would follow storage in open-air piles. It is in preventing decomposition and possible ignition by spontaneous heating that water storage is most valuable.

Coal storage by producers, to form a shipping reserve, or under compulsion by transport deficiencies or a flooded market, is generally for short periods only; a certain amount is always in store, but it is not the same coal throughout. On the other hand, storage by a large consumer is to form a real emergency reserve, and if the coal be stored under water it can be kept almost indefinitely. So long as it can be taken out as fast as it is required in emergency, there is no need to sacrifice anything to convenience of filling and emptying, and where land is valuable there is no reason why buildings should not be erected over the storage tank, using conveyors for loading and unloading. The latter do not need much headroom, and by handling the wet coal in a thin continuous stream, it is given most opportunity to drain before use. In such installations a certain working reserve of fuel should be kept in an open stack or, usually, in overhead bunkers filled straight from trucks on a railway siding. The cost of water storage equipment is not excessive, and is practically limited to that of the tank itself. The filling and emptying pumps need not be very powerful, and their cost is at least saved on the coal-handling gear, for this has to extend over a smaller area than where open storage is practised.

The cost of a complete mechanical coal-handling equipment is justified by the less breakage of fuel, by its more expeditious handling, and by the saving in labour costs. The mere fact that an extensive coal plant can be controlled by one or two men is specially important to central stations in times of labour trouble. The telpher system is cheap, convenient in operation and flexible in application. It permits of continuous and practically automatic working. The coal routes can be adapted to any shape of yard in any stage of filling. A travelling terminal bridge with adjust-

able trips permits coal to be placed or removed just where desired, and one or two men can operate an equipment conveying 60 tons an hour over a mile or more. In the new Bordeaux harbour works, for instance, a double aerial-transporter system carries coal 1¼ miles from the wharf to railway yards and warehouses, &c., where it delivers into shoots on a terminal tower. Thence the coal falls into trucks or on to a belt conveyor running along a travelling gantry, and spreading material evenly all over the pile. Grab-buckets, of 20 or 30-cwt. capacity, on the gantry, provide for subsequent collection of the coal. The tipping transporter buckets run on an overhead cable or rails, and are towed by an electrically-driven tractor cable at nearly three miles per hour. Up to 200 tons an hour is handled by each transporter (4,000 tons a day total) by this all-electric equipment.

In the case of a station served by river or canal and railway, there are five coaling operations to be provided for, viz., from waterside to boiler house or storage, from sidings to boiler house or storage, and from storage to boiler house. Experience in the national coal strike a year or two ago showed that six or eight weeks' supply was the minimum coal reserve with which a central station should be provided, *i.e.*, storage must be arranged for anything from 10,000 to 100,000 tons or more (the New York Edison Co. has 150,000 tons storage, besides overhead bunkers in its stations). Safety demands that the reserve be near the station, not only for convenience, but also because the "sympathetic" strikes of the twentieth century are apt to paralyse transport and coal supply simultaneously. On the other hand, it is not always possible to accommodate the vast reserve desirable, in yards immediately adjoining the station, for as shown by the following data (based on 45 cb. ft. per ton) over 2 acres would be required to store 60,000 tons in a stack 30 ft. deep (the limiting safe depth for dry stacks of most coals) :—

Depth of Pile.	*Storage per Acre.*
20 ft.	19,500 tons.
30 „	29,000 „
40 „	39,000 „
50 „	48,500 „
80 „	77,500 „

To store even 20,000 tons requires a heap 600 ft. long, 50 ft. wide and 30 ft. high (or its equivalent), so that if land be dear or scarce round the central-station site, a few days' supply may be kept on the latter, and the remaining reserve within easy reach by private light railway or telpher system.

REVIEWS.

Experiments. By Philip E. Edelman. Minneapolis, U.S.A. : P. E. Edelman. Price $1.50.

It is seldom that we have read so refreshing a book on Science as this little volume on "Experiments," by Mr. Edelman. The author sets out to give a "Complete account of experimental work in Science, invention, the industries and the amateur field, with practical illustrations and working directions," and if he has not succeeded in giving his "complete account," he has at any rate written a book at once suggestive and inspiring.

The volume is dedicated to "all those who have encouraged and contributed to the progress of experimental work," and the author has prefaced his book with an able essay on the value and need of experiments. He points out that progress only comes about through experiments, and that it would be difficult to think of even a few things that we possess that have not come to us by experiments; but at the same time he draws attention to the fact that a large amount of experimental work is being done by "hit-or-miss" methods, which naturally give meagre results for the time and energy expended; and he lays special stress on the advantage of possessing a sound knowledge of fundamental principles as well as experimental skill and resource. This volume comprises two distinct books, one part devoted to experiments which may be repeated, the other leading to new and original work.

Chapter I deals with models, copies and makeshifts, and describes the latent possibilities of old cans, jars, sticks, paper, string and glue in the production of working models. Chapter II consists of 12 sections devoted to simple experiments in chemistry, including the preparation and properties of common substances such as oxygen, hydrogen, water, ammonia, acids and sulphur. Then follow chapters in which most of the wonders of chemical technology find a place, *e.g.*, thermit-welding, catalysis, electro-deposition and rubber substitutes. Electricity naturally occupies a considerable space in this book of experiments; a chapter is devoted to the construction of small electric motors, and the details of construction are so carefully given, that it would be difficult for the merest novice to fail to make a workable machine. Some very interesting experiments are also described on electric heating, welding, &c.

In Chapter XI, four of Faraday's experiments on electro-magnetic induction are described, and the repetition of these classical experiments is suggested as leading up to other experiments on transformers, &c., to be described later in the book. There can be no doubt of the value of the repetition of fundamental experiments such as these, and if such a course were taken in other branches of science it would probably lead to a far better understanding of the fundamental principles. The more complicated and consequently less instructive experiments often performed in school laboratories could well be replaced by repetitions of the original experiments of Oersted, Volta, Faraday, and Maxwell.

Another chapter includes an account of the construction of a small transformer, a spark coil, an interrupter, and an ozonator, all of which are made of quite inexpensive and easily procurable materials, but which are, nevertheless, capable of doing good experimental work on a small scale. There is in Chapter XIII an account of how to make and use a small wireless station, and the author's reputation as a writer on wireless subjects naturally gives considerable weight to whatever he may say on this subject. To the description of the wireless telegraph is also added an account of a wireless telephone, which may be easily set up to operate over distances of 70 to 80 ft. In the remaining chapters of Book I experiments are described with Tesla coils and ultra-violet and X-rays; one section is devoted to Experimental Aeronautics, and the final chapter to Microscopic Photography.

From such a number of experiments it is difficult to make a selection; there is so much that is valuable and so little dross, that justice can only be done by reading the book from cover to cover.

Book II, which deals with the principles of research and invention, although occupying less than a quarter of the whole volume, is nevertheless a most interesting collection of suggestions and examples. The methods and principles of research work are carefully set out, and although it is obviously impossible to do more than merely point the way to successful researching, yet many pitfalls may be avoided and much time saved by following the very sound advice given in these few pages. Some chapters are added on Radio-research and Commercial Testing, which serve as examples of the general methods described earlier in the book.

It is interesting at this time to notice the author's opinion stated at the end of his book, that "Scientific endeavours are least affected by periods of military activity . . . . and progress continues in spite of economic and destructive losses."

It is impossible to read this book without feeling an increase in "keenness," a passion for experimenting, and a desire to convert the "vast potential possibilities" into the "kinetic realities" mentioned by the author.—P. K.

Wireless Telegraphy. By Rupert Stanley, B.A. London : Longmans, Green & Co. Price 7s. 6d.

Though there are already a considerable number of text-books for students on the subject of wireless telegraphy, it will generally be conceded that Prof. Stanley's work is a welcome addition. It is arranged and written in a manner that will appeal well to the student and give him a useful

insight into the theory of the subject. This affords sufficient warranty for its appearance, and for the same reason parts of it will be examined in some detail in this review. It will therefore be understood that the criticisms made will, in general, apply rather to specific points than to the character of the work as a whole.

The symbols C and K, for current and capacity respectively, are in general use throughout the book, in spite of recent conventions, but the reviewer is not disposed to quarrel with this, as it really seems a pity to try to upset such well established expressions as C^2R and $1/2KV^2$.

The second chapter is devoted to a brief consideration of matter and electrons, with the idea of imbuing the student with the electron theory of electrical phenomena, especially in regard to radio-telegraphy. Hence we learn that an electric current along a wire is nothing more or less than a flow of electrons along the wire, or from atom to atom in the wire. It is not clear to the reviewer how this conception is of real help to the deep-thinking and serious student, and it certainly appears to be one on which he is likely to ask some awkward questions. Thus, considering a linear oscillator whose linear dimensions are almost half the wave length given out, if the oscillating currents along the conductor are alternate fluxes of electrons (which are negative charges of electricity according to the theory), then it is reasonable to ask if the positive charges at one end of the oscillator remain quiescent until the electrons from the other end reach them. If this one-sided explanation be conceded, then seeing that it takes a quarter period for the positive charges to be annulled, it follows that a movement of electrons along the whole length of the oscillator has occurred in the same time, thus postulating a mean velocity, including starting and stopping, of nearly twice the speed of light, and this in spite of the fact that electrons possess inertia. There are cogent theoretical reasons why the velocity of electrons may not exceed the speed of light as a maximum, and it would be interesting to know where the fallacy lies. Again the student may well ask why, if the electrostatic field is made dissymmetrical in this way, the magnetic field is not also dissymmetrical. It will also be legitimate to ask how it comes about that the grounded loops of strain which form part of the propagated wave in an ordinary wireless system travel over the surface, seeing that one set of grounded extremities of the loops postulate positive charges on the surface of the ground. Do the negative charges push them on? These are only a few of the questions that would present themselves due to the assumption that it is only negative electricity in motion that constitutes a current. It is the reviewer's suggestion that while electrons (or, preferably, "corpuscles") have a useful and well-defined place in the theory of the constitution of matter, the time is not yet ripe to assume that electric currents are in all cases electronic fluxes; and, further, that such assumption is liable to confuse the serious student. Just as the author of the book directs the student's attention to magnetic strain apart from the magnet which produces it, so it is possible to direct his attention to the electrostatic strain apart from the nature of an electric charge.

Another point of theory on which the author appears to deceive himself lies in the statement that a current can only flow in a wire when it connects two conductors which are charged to different electric potentials. But a current can be made to flow in a circular circuit by a changing magnetic flux without any difference of potentials.

In dealing with questions turning upon the conductivity of the upper atmosphere, the author seriously misquotes Sir J. J. Thomson (unless the reviewer is badly mistaken). The error is a very common one, hence there is all the more reason for pointing it out. The atmosphere at a certain stage of rarefaction is said to have better conductivity for high-frequency currents than sea water, and for this statement Sir J. J. Thomson is quoted as authority. Surely, what Sir J. J. Thomson's experiments showed was that rarefied gas when violently ionised and in disruptive activity through electric stresses of relatively prodigious intensity, possessed this degree of conductivity. If the whole of the upper atmosphere were rendered intensely luminous by electrical activity then we might expect the degree of conductivity referred to.

In the more practical part of the book there are a few points on which comment might be made. Thus the author dwells too much on the need for winding secondaries of spark coils used for charging condensers with comparatively thick wire. There is not so much in the argument as the author appears to think, and it would possibly appeal better to the student if the limitation of condenser voltage were considered rather from the point of view of energy transference from the magnetic field of the spark coil to the charged condenser.

In regard to the question of coupling, the author appears to hold the fallacious view that if energy can be prevented from returning into the closed circuit of a coupled sender, then the radiation of a pure wave length is assured. The assumption apparently is that coupling waves are given off in succession, and this appears to be the view adopted by many. It will hardly be necessary to point out to any mathematical student that the Fourier series is the same, whether we wait till the energy begins to return to the closed circuit or consider only the initial part of the radiation. Out of this fallacy there has been an attempt made to claim special qualities for certain disk discharger transmitters. It is unfortunate also that the author follows the wrong lead given by certain wireless experts in assuming that because a spark gap is shortened the spark resistance is necessarily less. The reverse is probably more frequent, as witness quenched spark transmitters.

Telegraphy—Preece and Sivewright. New edition; revised by W. Llewellyn Preece. London: Longmans, Green & Co. Price 7s. 6d.

In its new edition this well-known text-book has been largely revised and extended, with the object of embracing more recent advances in telegraphy and telephony. The work of extension and revision has been undertaken by Mr. W. Llewellyn Preece. New chapters have been added on the Baudot system, on comparative results obtainable with high-speed telegraph systems, and on secondary batteries. Practically all other chapters have been very much revised. Those on telephony and on wireless telegraphy are stated to be of a purely introductory character.

The work is well got up and forms a very presentable volume. In the matter of bringing up to date it is in some respects disappointing. In one or two cases modern forms of apparatus or appliances have not been referred to. Thus, old-fashioned forms of Wheatstone A B C apparatus are fully described and illustrated, whilst more efficient modern forms are not alluded to.

The chapter on secondary batteries is marred by inexact methods of expression. For instance, it is stated that the internal resistance of accumulator cells does not exceed ·0015 ohm, without allusion to limitations imposed by the dimensions of the cells or other factors, and a definite figure for density of electrolyte when a cell is discharged is given without reference to the quantity of electrolyte in relation to the capacity of the cells. Nor is it made clear why "more distinct signals" are obtained as a result of using accumulators for telegraph purposes. A reference to the matter of working costs, as compared with primary batteries, would not be out of place. In regard to the chapter on telephony, it is observed that no explanation of working principles of speech transmission on central-battery methods is attempted, though a number of figures are given, and the signalling arrangements are explained in some detail. In figure 206 a distinctly objectionable method of jointing paper-insulated cable wires is illustrated. On page 229 a heat coil is most inadequately described as a small coil which fuses should a heavy current flow on the line. From these examples it will be seen that the work is capable of much improvement.

The section on wireless telegraphy cannot be commended. Admittedly a large amount of ground is not covered and the matter given is only intended as introductory, but many of the statements made are open to a considerable amount of criticism. Thus, on page 378 an inaccurate definition of coupling is given in which the term is made to refer only to the windings of the "jigger," whereas it embraces the whole primary oscillation circuit on the one hand, and

the whole aerial oscillation system on the other. Of these the "jigger" is usually but a small part. Again, in explaining the early Lodge method of shock excitation on page 368, reference is made to the closed-circuit oscillations being quickly damped (why, is not apparent) and to the aerial circuit being free to oscillate, *having but little inductance*. The italics have been added. Nor is it at all clear upon what grounds the statement is made that the Marconi transmitter in its later developments is "an extremely close approximation to the ideal requirements of a transmitting wireless station." It is more than doubtful whether there are any extremely close approximations to the ideal in wireless telegraph transmitters at present.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 19th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General Meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Friday, March 19th. At Royal Technical College, Glasgow. Paper on "The Use and Abuse of Oils in Connection with Electrical Plant," by Mr. T. C. Thomsen.

(Notts. and Derbyshire Branch).—Saturday, March 20th. At 3.30 p.m. At University College, Nottingham. Papers on "Turbine Pumps for Colliery Pumping," by Mr. R. H. Willis, and "Utility of Surface Earthing on Armoured Systems," by Mr. W. Webster.

Electro-Harmonic Society.—Friday, March 19th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 19th. At 7.30 p.m. At the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. Paper on "The Future of British Engineering and Shipbuilding," by Mr. E. W. Fraser Smith.

Association of Engineers-in-Charge.—Thursday, March 25th. Visit to the House of Commons, Engineering Department.
There will be no meeting on March 27th.

Institute of Marine Engineers.—Tuesday, March 23rd. At 8 p.m. At Tower Hill, Minories, E. Paper on "Comparative Efficiency of Lubricants," by Mr. J. Veitch-Wilson.

Institution of Electrical Engineers.—Thursday March 25th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Telephone Troubles in the Tropics," by Mr. W. L. Preece.

(Manchester Local Section).—Tuesday, March 23rd. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electric Cooking, mainly from the Consumer's Point of View," by Mr. W. R. Cooper.

Royal Institution of Great Britain.—Friday, March 26th. At 9 p.m. At Albemarle Street, W. Paper on "Experiments in Slow Cathode Rays," by Prof. Sir J. J. Thomson, F.R.S.
Saturdays, March 20th and 27th. At 3 p.m. Lectures (V and VI) on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Physical Society of London.—Friday, March 26th. At 5 p.m. At University College, Gower Street, W.C. Paper on "The Change of Thermal Conductivity with Fusion," by Prof. A. W. Porter, F.R.S., and Mr. F. Simeon.

NOTES.

Correction.—In our last issue under "Official Returns of Electrical Companies," appearing on page 364 we, by a printers' error, which we regret, reported the debentures of the E. S. Co., Ltd., as £20,000, instead of £2,000. Our readers will remember that in our notice of the registration of the company (ELEC. REV., February 12th) we correctly reported the capital of the company as £2,000. The operations of the company were further referred to in our issue of February 19th.

Electro-Harmonic Concert.—We wish to remind our readers that the last of the Electro-Harmonic Society's concerts for the season takes place to-night at the King's Hall, Holborn Restaurant. The large and enthusiastic gatherings at all the events of the season so far have proved that the Committee did not err in considering that electrical men wished the concerts to be kept running as usual as a relief from the stress and strain of these serious times, and it is hoped and believed that to-night there will be a large and representative company present to meet their friends and to enjoy the varied and appropriate programme that has been prepared. Sir John Snell will be in the chair.

Trade Announcement.—MESSRS. ESTLER BROS. are temporarily closing their office at Dowgate Hill, E.C., from Monday, March 22nd, and their sole office in London will be at the works, South Molton Road, Victoria Docks, E. Telephone Nos.: "East 320" and "East 4070"; telegraphic address, "Isolable, London."

Patents and Alien Enemies.—In connection with the Thermit process for welding rails in Australia, Mr. Hughes, the Attorney-General, has suspended the Goldschmidt patents in favour of the Engineer-in-Chief of the Commonwealth railways.

The Board of Trade has granted a licence to Messrs. Ed. Bennis and Co., Ltd., in respect of Patent No. 8966/1903, granted to Bousse,

Late Legal.—BRITISH INSULATED & HELSBY CABLES, LTD. *v.* CRITTALL.—The concluding stage of the hearing of this case, which is reported on page 389, was reached on Wednesday, when Mr. Greer, K.C., counsel for the plaintiffs, completed his comments upon the whole of the evidence. The Official Referee said that owing to the nature of the case, and its length, he would have to take time to consider his judgment and put his decision in a satisfactory shape.

THE ARC LAMP CARBONS CASE.—Mr. Justice Eve, in the Chancery Division on Wednesday, March 17th, heard an action by the Beck Engineering Co., Ltd., and A. M. Billington, against the Sloan Electrical Co., Ltd., for a declaration that they were entitled to a stock of about 213,000 carbons for electric arc lamps lately stored at the Foster Engineering Co.'s premises at Wimbledon, and an injunction restraining the defendants from disposing of them. The defendants counterclaimed for damages in respect of an alleged trespass on the Foster Co.'s premises when the stock of carbons was removed by the plaintiffs. The Foster Co. were originally defendants, but were dismissed from the action last October.

The plaintiffs' case was that they had an agreement with the defendants, who acted as agents for a Mr. Conradty, of Nuremberg, a maker of carbons, to keep a stock of carbons at Wimbledon from which they could draw in connection with the making of the Beck electric flame lamp, and that upon the cancellation of the agreement they were to be at liberty to purchase the stock at the current price. The question was what was the meaning of the phrase "current price."

His Lordship held that "current price" meant the price ruling at the time the carbon was taken from stock and sold, and not the price agreed upon between the parties two years ago. He dissented from the view that the purchaser was to have the right for the duration of the agreement to insist upon having his goods at a price which might mean making them at a loss. He dismissed the action with costs, and said it really should have been brought against the German maker. He also dismissed the counterclaim on the ground that the Foster Co. were not bailees of the goods for the defendants, but for the plaintiffs or the maker.

Appointments Vacant.—Switchboard attendant (25s.), for Stretford U.D.C.; switchboard attendant (35s.), for Portsmouth Corporation; junior assistant (£88), for Sheffield Electric Supply Department; switchboard attendant (32s.), for Burnley Corporation; electrical fitters (39s.), for drawing office, H.M. Dockyard, Portsmouth; switchboard attendant (37s.), for Wakefield Corporation. See "Official Notices" to-day.

The Electric Vehicle Committee.—At the last meeting of this Committee it was reported that there had been a further demand for the *Electric Vehicle* journal; the main feature of the June issue will be "The Municipal Uses of Electric Vehicles."

The General Electric Co. has been appointed the official manufacturer to the Committee for 12 months, from April 1st, for the illuminated type of charging station signs, and the Patent Enamel Co., of Selly Oak, Birmingham, has been appointed the official manufacturer for the same period for the enamel plate type.

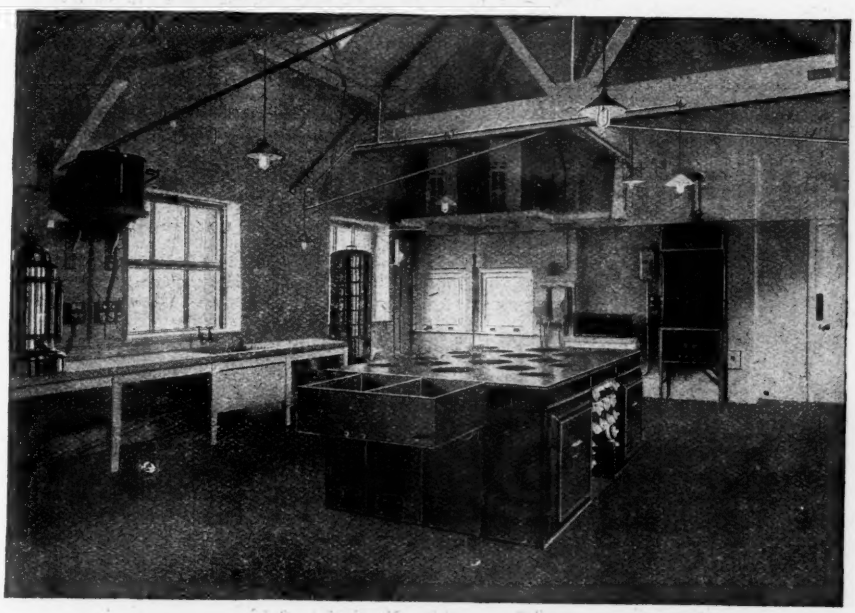
As to the standardisation of metal-filament glow lamps for use on electric vehicles, the Committee has had before it samples of fittings, and in view of the restricted amount of room has decided to recommend, as standard for electric vehicles, the lamps of the size and voltage recommended by the Engineering Standards Committee (Report No. 69). These lamps are for a pressure of 12 volts and, in view of the small energy consumption and the comparatively short hours of use, the Committee recommends that, for the present, they be coupled across such a number of cells in the vehicle as will give the required voltage, and that a special extra terminal be provided on the cells for this purpose.

The Technical Sub-Committee is still engaged in drawing up a report as to the methods of charging and standardisation of charging equipments.

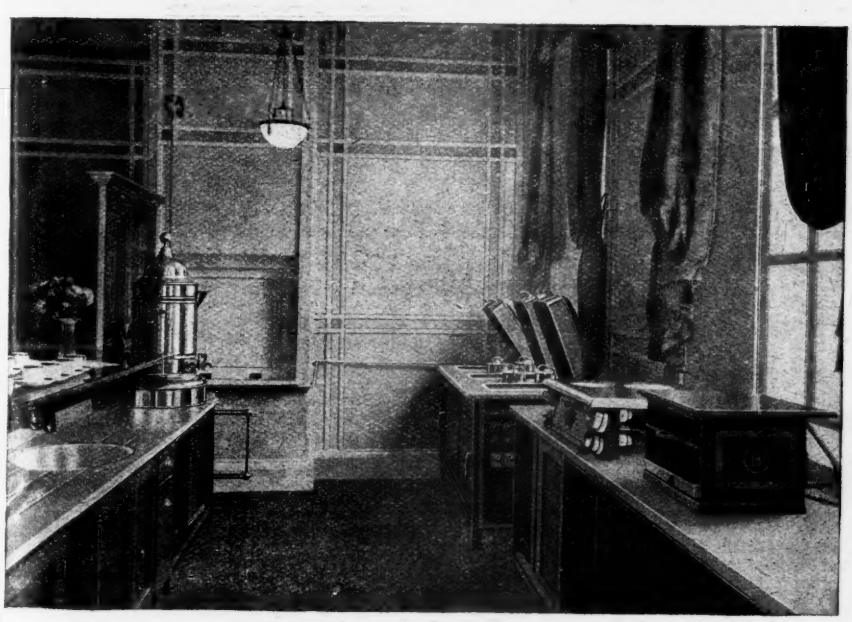
The secretary was directed to write to those London municipal and company undertakings charging more than 1d. per unit for "off-peak" supply, expressing the hope that they will reconsider this matter and come into line with the large number of supply undertakings which have already adopted the Committee's standard tariff.

Fatality.—SHEFFIELD.—An inquest was held on 10th inst. into the death of Walter Carley, a lad of 14 years, who was on the previous Sunday fixing an electric light outside his brother's scullery in Attercliffe Road. He had been apprenticed for five or six weeks to an electrician. His brother tried to dissuade him from attempting the job. After the work had been finished, his sister-in-law heard a cry and found him hanging from the wire by his arms and with a pair of pliers in his hands. One of his legs was in a water tub and the other was drawn up. An employé of the Corporation electricity department said that the voltage was 200, and if deceased had caught the wire with the pliers the pressure would have sufficed to kill him. The boy had no right to be doing the work. The rules showed that the electricity department must be notified when any work of the sort was to be done, and the work had to be reported when completed, but in this case no notification had been sent. The wire was not the proper wire for the purpose, and the work had not been carried out properly. The Coroner said that apparently it was a fairly simple job, and had been completed, but carelessness afterwards in interfering with the wire while alive caused the death. A verdict of "Accidental death" was returned.

Electric Cooking at the Bradford Kursaal.—As briefly reported in our last issue, the Bradford City Council last week opened the Kursaal with the first electrically cooked dinner on a large scale that has taken place in the city; the plant was installed by the officials of the Electricity Committee, and was supplied by the Brompton and Kensington Accessories Co., Ltd., London, with the exception of a geyser and towel rails that were supplied by the British Electric Heater Co., of Glasgow. The



Interior of the Main Electrical Kitchen, Bradford Kursaal.



Electrical Cooking Equipment, Ground Floor Café.

equipment is capable of cooking a table d'hôte dinner for 500 persons, and consists of the following items:—

One central range, fitted with bain marie, overall dimensions 9 ft. 3 in. × 5 ft. × 2 ft. 9 in. high, fitted with four ovens of 4 KW. each, and measuring 2 ft. high × 2 ft. 2 in. deep × 2 ft. wide; the frame is of cast-iron, stove enamelled black, with ground bright facings and bright boiling table.

The latter is fitted with four 2-KW. 12-in., six 1·5-KW. 10-in., and eight 1·2-KW. 8-in. boiling rings.

The ovens and boiling rings are arranged for three regulations, viz., "high," "medium," and "low." The switches and fuses are mounted in conspicuous and easily accessible positions, and each oven and boiling ring has an indicator lamp to show when the current is on.

The bain marie is 2 ft. 8 in. × 1 ft. 9 in. × 6 in. deep, and is divided into two compartments, separately controlled by switches and fuses, and taking a maximum of 3 KW.

One circular steamer tinned inside and nickel-plated outside, 19 in. in diameter, with six 6 in. deep steaming compartments fitted internally with steam channels and draining holes. The steamer is controlled by three heaters which may be used singly or collectively, taking 4·5 KW.

One fish or potato frier made of blue planished steel with bright mouldings, and having a compartment 2 ft. × 18 in. and of ample depth. This is fitted with two heaters taking 4 KW., and is controlled by four switches for easily adjusting the temperature of the fat in which the frying takes place.

Grill.—This has a grilling area of 24 in. × 12 in., and is made of cast-iron and fitted with grill guard, grilling grid and drip tin. The loading is 4·5 KW.

One 10-gallon nickel-plated copper hot water urn for drinking purposes, taking 3·5 KW.

One 10-gallon copper cylinder mounted on the wall, fitted with ball cock and water gauge for providing hot water for washing-up purposes, pipes being connected to sinks for this purpose. This takes 6 KW.

Ground Floor Café.

One carving table and hot cupboard, measuring 6 ft. 6 in. × 2 ft. 6 in. × 2 ft. 9 in., mounted on castors, and fitted with three tinned copper carving dishes, 19 in. × 14 in., with hinged covers, and four 7-in. nickel plated gravy and sauce pots. The hot cupboard underneath has internal dimensions of 5 ft. 9 in. × 2 ft. 1 in. × 2 ft. high.

There are three regulations of heat provided with this apparatus, which takes 3·5 KW.

One double lined nickel-plated coffee or milk urn of five gallons capacity, taking 2·5 KW.

One 10-gallon hot-water urn for drinking purposes, 3·5 KW.

One bread toaster, having a toasting surface of 17 in. × 11 in., 2·5 KW.

One breakfast cooker, 2 ft. 6 in × 2 ft., containing two 8-in. boiling rings, one 6-in. boiling ring and one 11-in. × 8½ in grill, with a total loading of 4·6 KW.

One electric hot-water geyser, fitted in the counter for providing hot water for washing-up purposes to two wash bowls, the amount of water being regulated. This takes 4 KW.

Middle Café.

This is fitted with one toaster (2·5 KW.), one hot-water urn (3·5 KW.) for providing water for drinking purposes, one coffee or milk urn (2·5 KW.), and one electric geyser (4 KW.), fitted to the wash bowls.

Electrically-heated towel rails, taking 150 watts each, are provided in each of the cafés, in order to ensure a supply of dry towels always being on hand.

An American Carbon Co.—According to the American *Electrical Review and Western Electrician*, the National Carbon Co., which early last year took over the American Ever-Ready Co., subsequently operating its works as branches of the National Co., showed very satisfactory results in 1914. The company now has ten factories in operation in the States and one in Toronto. A new factory has been completed at Jersey City, and a large one is completing in Long Island City. The profits are reported as equal to 26 per cent. on the common stock, as compared with 15 per cent. for 1913. The preferred and common stocks aggregated $15,565,000, as against $10,000,000. The profit advanced from $1,476,621 to $2,215,880. The dividend distributed on preferred stock advanced from $315,000 to $372,750, and that on the common stock increased from $330,000 to $582,930. A bonus of $25,000 was paid to employés as against nothing in 1913, and the surplus figures at $825,618 as compared with $495,907.

Board of Trade Assistance.—The Commercial Intelligence Branch of the Board of Trade has issued lists 10, 11 and 12 (for the weeks ended February 27th, March 6th and 13th) of articles which inquirers desire to purchase.

British firms interested, as suppliers, in any of the goods mentioned should communicate with the director of the Branch at 73, Basinghall Street, London, E.C.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The opening meeting of the CALCUTTA LOCAL SECTION took place on January 28th, when the address of the chairman, Mr. W. H. Everett, was read by the vice-chairman, Mr. A. K. Taylor. The address dealt with the electrical industry in India; it was shown that in the supply of apparatus and machinery for electric lighting and power the United Kingdom held by far the largest share, and telegraph and telephone apparatus and materials were almost entirely derived from this country. The total imports in 1913-14 exceeded one million sterling in value, the provinces of Bengal and Bombay providing 78 per cent. of the demand. The principal schemes in operation, or in progress in India, were the following:—

Water Power.—Tata Power Co., Bombay, 32,000 KW. (to be increased to 100,000 KW.); Cauvery Falls, Mysore, 12,400 KW; Jhelum River, Kashmir, 4,000 KW.; Darjeeling, 2,500 KW.; Mussoorie, 1,900 KW.; Simla, 750 KW.; Jammu, Kashmir, 700 KW.; total, about 54,000 KW.

Steam and Oil.—Calcutta, 14,800 KW.; Calcutta Tramways, 2,900 KW.; Bombay, 9,000 KW.; Rangoon, 5,400 KW.; Madras, 3,800 KW.; Colombo, 1,550 KW.; Kolar Mines Co., 1,500 KW.; Dacca, 900 KW.; Delhi, 840 KW.; Cawnpore, 850 KW.; Gwalior, 700 KW; Lahore, 600 KW.; Kandy, 540 KW.; Mandalay, 520 KW.; Bikanir, 500 KW.; total, about 58,000 KW., of which about 1,800 KW. is generated by Diesel oil engines.

Power was being transmitted over distances up to 92 miles, at pressures up to 100,000 volts. The author estimated that the rainfall in the uplands represented something like 1,000 million H.P., and if only 1 per cent. of the total could be utilised commercially it represented an immense annual value; the energy might be used for the production of artificial fertilisers, the electrification of railways and industrial power. In Calcutta already some 1,229 motors, aggregating 10,263 B.H.P., were in use for commercial purposes. Better provision was being made for the technical training of electrical engineers.

The following gentlemen have been nominated for the respective offices in the SCOTTISH LOCAL SECTION:—Chairman, Mr. D. A. Starr; vice-chairman, Mr. J. K. Stother; hon. secretary, Mr. Joseph Taylor; assistant secretary, Mr. Wm. F. Mitchell; chairman of Students' Section, Mr. Arch. Page; Committee, Messrs. Wyatt (Greenock), W. W. Lackie, Prof. Maclean (Glasgow), Messrs. Arch. Wilson (Edinburgh), J. S. Nicholson, James Sayers, E. T. Goslin, George Stevenson, A. S. Hampton, and Prof. Cormack, Glasgow. The nominations will be confirmed at the annual general meeting in Glasgow next month.

STUDENTS' SECTION.—The following further arrangements are announced for this session:—

March 31st.—Discussion on the applications of electrical engineering to warfare:—"Searchlights and Projectors," to be opened by E. L. Emtage.
April 14th.—J. M. Heslop. "The Electric Drive of Rolling Mills."
April 28th.—Annual General Meeting. Lecture on "The Paragon System," by W. P. Durtnall.

At the meeting of the BIRMINGHAM LOCAL SECTION, on Wednesday last, Mr. W. R. Cooper read his paper on "Electric Cooking."

Birmingham Electric Club.—On Saturday last a lecture was given by Mr. W. E. Warrilow on "Electric Vehicles," which was illustrated by lantern slides. In the course of the discussion, Mr. W. A. Jackson (borough electrical engineer, West Bromwich) said that the petrol 'buses in his district had been commandeered by the Government; they got some more, but, fortunately, the Government took them also, and then they got Edison battery 'buses. The last were slower and more costly to buy, but, on the figures guaranteed by the makers, they would save £400 per annum over the petrol-driven 'buses, and he was confident that as a result of experience with them the West Bromwich Corporation would ultimately replace the horse-drawn vehicles used by the street cleansing departments with electric dust carts, &c. Mr. Hargreaves (Edison Co.) said he took three commercial vehicles a distance of 3,000 miles through the Midlands last summer and had experienced no difficulty in obtaining a charge.

Municipalisation of the Berlin Electricity Works.—It is officially announced by the Berlin City authorities that the "majistracy" decided at the meeting on February 23rd to proceed with the municipalisation of the Berlin Electricity Works. As a result of the course of events, it is said that room no longer exists for a conflict of opinion within the majistracy or for a decision of a majority against a minority in the matter. The lignite coal fields of Golpa-Jessnitz, which have been held in prospect by a company associated with the Berlin Electricity Works Co. and the A.E.G. for meeting the supply of energy for Berlin, are now intended for other purposes in the interest of the country, and no other solution therefore is presented than that of taking over the works for municipal administration. As a result of this announcement the city of Berlin will acquire the works on October 1st next provided that the City Council itself agrees to the scheme which has just been placed before it for this purpose. It is, however, considered probable under the prevailing circumstances that as in the majistracy, so in the Municipal Council itself, will there be a majority of votes cast in favour of the scheme. The present agreement expires in October, and in view of this fact the city has been in negotiation with the Berlin company for a long time past with the object either of securing considerably more favourable terms for supply and a larger share in the profits, or, if this were not possible, of taking over the undertaking. The question of converting the works into a joint private-municipal enterprise has been dismissed for practical reasons as well as on account of opposition offered to the suggested community of interests, whilst the diversion of the distant lignite fields to the other objects has also placed a different complexion on the question. During the past few years the city has received from the company about £350,000 per annum as tax and share in the profits, and the decision to absorb the undertaking is based upon the assumption that the net yield to the city will be greater than this sum under municipal administration. It is calculated that the purchase price, which will be settled according to the book value on October 1st, will reach about £6,500,000; but the raising of the necessary money under existing circumstances will be difficult, whilst money is expected to be dearer after the conclusion of the war. The reference previously made to the extensive lignite coal fields of Golpa-Jessnitz is explained by the fact that the company concerned has just entered into a contract of many years' duration for the annual supply of 500,000,000 KW.-hours to an undertaking which is to produce artificial fertilisers, and a second company is being formed which will require a further quantity of 250,000,000 KW.-hours every year.

London Electrical Workers' Demands.—We have received the following communication:—

"The following is a brief account of a meeting of the London members of the Union:—

"At a largely-attended meeting of the London members of the Electrical Trades Union it was decided by an overwhelming majority of those present, to press for an advance of wages of 1½d. per hour for all grades of electrical workers employed in the metropolis. The application presented to the London Electrical Masters' Association for one shilling per hour with a 48-hour week was ratified, and it was further decided that a special code of working rules for men engaged on ship work should be circulated to all employers in the Port of London.

"The wiremen employed on the London County Council tramways, both members of the Electrical Trades Union and non-members, struck work on Saturday last to secure the recognition of 10½d. per hour as the minimum rate. Should there not be an early settlement satisfactory to the men, it is stated there may be an extension in dispute. The London Electrical Masters' Association agreed with the Union that the rate for wiremen should be 10½d. per hour as from July last.

"J. POTTER,
"*Dis. Sec., Elec. Trades Union.*
"Kilburn, N.W., *March 17th*, 1915."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Before leaving to take up his new appointment with the Pirelli Co., Ltd., MR. W. A. BROWN, who was the distributing engineer to the St. Pancras Borough Council for a period of nearly 18 years, was the recipient of an electric hot plate from the clerical staff, and a set of cut-glass rose bowls from the men and staff of his department. Both presentations were made by Mr. Sydney W. Baynes, the chief electrical engineer, who expressed the regret of all at Mr. Brown's leaving the service, and wished him every success in his new sphere. At a meeting of the Electricity Committee on the 11th inst., the Mayor (Alderman Joseph May), on behalf of the Committee, presented to Mr. W. A. Brown a silver stop watch suitably engraved, as a memento from the Committee, and spoke in highly complimentary terms of his services to the Council.

The Bingley Council's Electricity and Tramways Committee recommended that the salary of the electrical engineer (MR. C. PEDLEY) be increased by £30 a year, and that of the assistant engineer by £26 a year. The recommendation was, after discussion, adopted.

It is recommended that the salary of MR. H. A. KELL, chief assistant engineer at the Luton electricity works, be advanced by £20 to £200.

The Stoke Newington B.C. has been recommended to grant the following increases in the salaries of members of the staff of the electricity department:—MR. S. HANN, electrical engineer, £280 to £290 per annum; MR. H. LARGE, chief assistant, £130 to £140, reserving for future consideration an honorarium for his services in acting as borough electrical engineer during Mr. Hann's absence with the Forces; MR. E. G. MACKENZIE, sub-station assistant, £2 to £2 2s. per week; MR. A. H. GAY, sub-station assistant, £1 15s. to £2 2s.; MR. A. E. COLLINGS, sub-station assistant, £1 15s. to £2; Mr. G. F. MALDEN, temporary sub-station assistant, £1 12s. to £2; MR. A. S. CUSHING, temporary sub-station assistant, £1 12s. to £1 15s., reserving further consideration of salary to take place after the lapse of six calendar months; MESSRS. FORD, RAYNER and LAWS, engine drivers, an addition of 2s. per week; MR. S. BONE, clerk, an addition of 4s. and MR. G. HODGES, night duty man, an addition of 2s. per week.

Tramway Officials.—The Plymouth T.C. has, by 46 votes to 10, rejected the recommendation of the Tramways Committee regarding the appointment of Mr. C. R. Everson, mentioned in the last issue of the ELEC. REV.

Southampton Tramways Committee has received 48 applications for the post of tramways manager. The following candidates have

been selected for interview:—Mr. H. Pilling, Accrington; Mr. F. Buckley, Wigan; Mr. W. Billington, Salford; Mr. W. T. Robson, South Shields Corporation tramways. A deputation has been appointed to visit the towns and to interview the selected candidates where they are at present engaged, and report.

General.—The undermentioned have been appointed members of the L.C.C. Highways Committee for 1914-15:—Lord Monk-Bretton, Sir John Benn, Messrs. D. Davies, G. A. Dutfield, H. H. Gordon, W. Haydon, G. H. Hume, W. Hunt, H. Marks, T. Prestige, A. C. Rawson, A. H. Scott, S. J. Thomas, H. Ward, and A. W. Yeo.

In the *London Gazette* on Tuesday the following appeared:—

Territorial Force.—*Electric Lights Company.* Roger H. Emmett, Robert Burleigh.

No. 5 Electric Lights Company; Alfred Thurston Taylor to be second Lieutenant, March 17th.

The Axbridge Board of Guardians has increased the salary of the electrical engineer at the workhouse (Mr. F. C. Harris) from £80 to £100 a year.

Mr. George Sutton, M.I.E.E., managing director of Messrs. W. T. Henley's Telegraph Works Co., Ltd., has been elected to succeed the late Mr. J. F. Albright, as chairman of the Kent Electric Power Co., and Mr. H. B. Harvey, M.I.E.E., who has for the past six years been the company's manager and engineer, has been elected to the vacant position of director.

It is announced that Mr. David Willock has been elected to a seat on the Board of the Electric Construction Co., Ltd., rendered vacant by the death of Mr. William Bulloch.

Mr. Alex. Spencer, a director of Messrs. George Spencer Moulton & Co., Ltd., has been elected a director of the British Westinghouse Electric and Manufacturing Co., Ltd.

In the Italian Senate on Tuesday, Mr. Marconi was introduced to the House as a new senator with the customary formalities. Press dispatches state that he was received with long and enthusiastic applause, in which the public in the gallery joined.

Obituary.—Mr. H. Ward Leonard.—We regret to read in our American exchanges of the death which occurred suddenly on February 18th in New York, of Mr. H. Ward Leonard. Mr. Leonard was 54 years of age, and at the time of his death he was attending the mid-winter dinner of the American Institute of Electrical Engineers, of which he was at one time a vice-president, and at another manager. The American *Electrical Review* says that when he was 23 years of age the deceased gentleman became associated with Mr. Edison, as one of four engineers on his staff selected to introduce the Edison central-station system, and three years later he was appointed general superintendent of the Western Electric Light Co. in Chicago. After some years in private consulting practice, he for a year or two acted as general manager of the light and power departments of the combined Edison interests for United States and Canada, and subsequently in 1891 established his own independent manufacturing business, which is still operating as the Ward Leonard Electric Co., at Bronxville, N.Y. For some years past, Mr. Leonard had not taken an active part in the affairs of the company, but had been engaged in experimental work and in the development of his many inventions. Practically all the ships in the U.S. Navy are fitted with his system of control, this application following upon the successful use of the system in one turret of the *Brooklyn* during the Spanish-American war. His system of motor control was applied to the moving sidewalk at the 1900 Paris Exposition after other systems had been applied unsuccessfully. He was an early worker in connection with the electric lighting of railway trains—indeed his first invention of all, in 1888, related to that subject. He was connected with many technical and other associations, had delivered many papers and addresses before them, and was awarded various medals.

Mr. F. E. Pollard.—The death has occurred at Hertford, at the age of 55 years, of Mr. F. E. Pollard, a member of the Research Sub-Committee on Insulating Oils appointed by the Institution of Electrical Engineers.

Mr. Thomas Swinyard.—The *Times* reports that the death took place in New York, on February 25th of Mr. Thomas Swinyard, who went to Canada in 1862, at the request of the British shareholders of the Great Western Railway Co. of Canada, as their general manager. He was appointed general manager of the Dominion Telegraph Co. in 1875, and subsequently president, an office which he held until his death.

Mr. Howell Ashbridge Godby, who had spent four years at Faraday House, and joined the H.A.C. at the beginning of the war, died on February 19th in hospital in France as the result of wounds received in action on February 14th.

In the latest casualty list there appears the name of Second-Lieut. J. L. Moffett, Royal Scots Fusiliers, who has been killed in action. Lieut. Moffett was 27 years of age, and obtained his commission last September. He was educated at Watford Grammar School and Manchester University, where he graduated B.Sc. (Eng.). He was an Associate of the Institution of Electrical Engineers. Up to 18 months ago he was engaged at the Lancs. and Yorks. Railway Co.'s Works at Horwich, near Bolton. He left there to take a position with the Chloride Co., at Clifton, near Manchester. He had been at the Front five weeks.

Will.—The late Mr. W. Edgar Allen, of Sheffield (Edgar Allen & Co., Ltd., Imperial Steel Works), left £271,068 gross and £251,792 net. Various charities and employés benefit to the extent of £150,000. After various legacies are dealt with, he leaves two-fifths of the residue to the University of Sheffield, partly to the Committee of the Applied Science Department, and partly for founding Edgar Allen Scholarships for students at the University.

NEW COMPANIES REGISTERED.

Drycells, Ltd. (139,605).—This company was registered on March 11th with a capital of £100 in 10s. shares, to carry on the business of manufacturers of electric refill batteries for pocket and other lamps. The subscribers (with five shares each) are: R. W. Gale, 259, Goldhawk Road, W., clerk; J. Dunkley, 46, Devonshire Road, Colliers Wood, Merton, S.W., electrician. Private company. The number of directors is not to be less than two or more than five; the first are R. W. Gale and W. H. R. Hargrave. Qualification £5. Registered office: 24, John Street, Bedford Row, W.C.

Sunlight Manufacturing Co., Ltd. (139,636).—This company was registered on March 13th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in electric batteries for pocket lamps and torches, general electrical goods and accumulators, magnetos, motor-cars, motor and other cycles, etc. The subscribers (with one share each) are: J. Abrahams, 54, Redcross Street, E.C., manufacturer's agent; P. Abrahams, 54, Redcross Street, E.C., manufacturer's agent. Private company. The number of directors is not to be less than two or more than five; the first are J. Abrahams and P. Abrahams (both permanent). Qualification 100 shares. Registered office: 1 & 3, Paxton Road, Tottenham, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sterling Telephone and Electric Co., Ltd.—Mortgage, dated 8th February, 1915, to secure £10,000 and further advances, charged on certain land at Dagenham, Essex, and company's undertaking and property, present and future, including uncalled capital. Holder: Secretary of State for War.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Charge, as substituted security on shares in Carville Site and Power Co., Ltd., which may be acquired by the company, dated 5th March, 1915 (supplemental to trust deeds dated 30th June, 1909, and 10th November, 1914, securing £854,500, debenture stock). Trustees: Rt. Hon. Viscount Ridley, and Rt. Hon. W. B. Cunliffe.

Foster Engineering Co., Ltd.—Issue on 10th February, 1915, of £2,208 7s. 3d. debentures, part of a series of which particulars have already been filed.

Carrara-Persilia Electric Railway and Power Co., Ltd.—Deed of further charge on a certain concession, and company's other assets, present and future, including uncalled capital, dated 25th February, 1915, supplemental to charge dated 25th May, 1914, to secure £40,000. Holders: Commercial Bank of Scotland, Ltd., 62, Lombard Street, E.C.

Curtis and Co., Ltd.—Particulars of £500 debentures, created 22nd February, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £50. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Rangoon Electric Tramway and Supply Co., Ltd.—A memorandum of satisfaction to the extent of £1,410 on 3rd February, and £4,785 on March 10th, 1915, of debenture stock, dated 1st February, 1906, 22nd December, 1908, and 5th November, 1913, securing £250,000, has been filed.

Edison Accumulators, Ltd.—Debenture, dated 10th March, 1915, charged on company's property, present and future, including uncalled capital, to secure all moneys due or to become due from the company to London County & Westminster Bank, Ltd., not exceeding £5,000.

CITY NOTES.

British Electric Transformer Co., Ltd.

The directors report that they consider the result for 1914 satisfactory. The accounts show that after paying all manufacturing costs and expenses of administration there remains a net profit of £16,235, plus £4,108 brought forward, making £20,343. They recommend that there be placed to reserve account £5,000, to depreciation reserve £1,500, preference dividend of 6 per cent. £3,719, dividend of 7½ per cent. on the ordinary shares £6,410, extra remuneration to the directors £237, leaving to be carried forward £3,478. The directors refer to the death of Mr. J. F. Albright, the chairman of the company.

Annual meeting: To-day.

Bath Electric Tramways, Ltd.

The traffic and other receipts for 1914 show a decrease of £1,410 for the 52 weeks compared with the 53 weeks of the previous year. But for the receipts obtained in respect of special military services rendered by the motor vehicles, the decrease in the earnings brought about by the war would have been more pronounced. Certain economies effected in operating costs have to a great extent been offset by additional expense incurred in connection with these military traffics. In September, 1914, the company was called upon to dispose of several of its torpedo cars to H.M. War Department. The cars thus impressed or disposed of to army contractors have reduced the motor fleet by 14 vehicles. Arrangements have, however, been made for replacing some of these vehicles at the earliest possible dates consistent with the requirements of the Army. The foundry belonging to the company continues to give most satisfactory results. Approximately one half of the company's employés have joined H.M.'s naval or military forces. After charging the expenses of operation and administration, there remains a balance of £16,133. After paying debenture interest and sinking fund charges, and paying the preference dividend for the year there is a balance of £5,224, which the directors recommend should be carried forward, and should be used towards replacement of the motor fleet, etc. They consider that, by the adoption of this policy, provision is made for depreciation in a most effective form.

Davis & Timmins, Ltd.—Sir Henry Mance presided at the annual meeting on 9th inst., and said that they had attained the results mentioned in the report in spite of the war, and not through business resulting directly from it. The outbreak of hostilities caused a serious set-back from which they did not entirely recover until nearing the end of the year, but their trading during the earlier months had been very satisfactory, and they were, therefore, able to show results nearly as good as those for 1913. Ready money had enabled them to secure the stock of metal absolutely necessary to carry on their work. They were full of work, and were likely to be so for a considerable time. Mr. G. E. Davis, the managing director, said that the opening of the war found them well equipped with good stocks of metal and an efficient plant. To-day they were in a favourable position to deal with the enormous pressure of orders that had been put upon them. The existing state of things was such that no man could tell what the difficulties of obtaining supplies, even against cash, might be in the near future, but anything that forethought and anticipation of events could do had been done, and would continue to be done. Though it was their first and bounden duty to give preferential treatment to war supplies, they were in no way neglecting their old customers, the mainstay of the business, and their best efforts were being used to cause them as little inconvenience as possible. Generally speaking, the whole of the works were employed on war material, either as contractors or as sub-contractors.

British Insulated and Helsby Cables, Ltd.—The profit for 1914 was £277,428, plus £98,267 brought forward, making £375,695. From this have to be deducted directors' and debenture trustees' fees, and remuneration to Works' Committee, £5,315; interest on first debenture stock, £22 500; interest on second debenture stock, £10,000; depreciation on buildings, plant, machinery, &c, £25,000; transfer to reserve account, £50,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; pension fund, £25,000: dividend on preference shares to December 31st, 1914, £30,000; interim dividend on ordinary shares to June 30th, 1914, £20,000, leaving available for dividend £174,380. The directors recommend a further dividend of 11s. per share on the ordinary shares, making a total of 15 per cent. for the year, £55,000, carrying forward £119,380. There has again been an increase in the volume of trade compared with last year, and this has resulted in an additional profit of £30,077. £25,000 is applied to depreciation on buildings, plant and machinery, as against £22,000 last year. An amount of £25,000 has been set aside to form the nucleus of a pension fund, and the directors will ask the shareholders to approve this proposal. Annual meeting, March 22nd, at Liverpool.

W. T. Henley's Telegraph Works Co., Ltd.—The directors report that during 1914 a profit of £119,246 was made. Deducting directors' and auditors' fees, debenture interest, income-tax, and amount written off for depreciation on buildings and machinery, £29,121, and adding £59,065 brought forward, there is a total of £149,191. Deducting transfer to reserve account, £20,000; transfer to special reserve account, £10,000; dividend on preference shares to December 31st, 1914, £9,000; interim dividend on ordinary shares, £10,000; and income-tax on interim dividend on ordinary shares, £771, there remains an available balance of £99,420. The directors recommend the payment of a final dividend on the ordinary shares of 10 per cent., less income-tax; making 15 per cent. for the year; and also a bonus of 5s. per share, less income-tax, and this will require £30,000, leaving £69,420 to be carried forward. Annual meeting: to-day.

Automatic Telephone Manufacturing Co., Ltd.—With reference to the paragraph in our last issue the directors' report now received shows that the profit for the year 1914 was £38,248 plus £3,219 brought forward. Directors' fees require £2,450, depreciation on patents, goodwill, buildings, plant and machinery absorbs £5,760, there is written off underwriting commission on shares £3,500, written off preliminary expenses £1,700, the dividend on preference shares requires £12,000, and after paying 3 per cent. on the ordinary shares, £5,256 will remain to be carried forward. During the year more progress has been made in the installation of automatic telephone equipment, and the general business of the company has been satisfactory. Annual meeting, March 22nd at Liverpool.

Dublin and Lucan Electric Railway Co.—Mr. J. W. Hill, presiding at the annual meeting, stated that the gross receipts were £7,367, being £40 less than in the previous year, and the expenditure had decreased by £12. The balance was £362, which was carried to next account, payment of cumulative preference dividend being postponed. Receipts for the sale of electric current in 1914 amounted to £208, against £142 in 1913. It was announced that the company had secured a favourable contract for the carriage of mails and parcels between Dublin, Chapelizod, Palmerstown, Lucan and Leixlip.

Mexican Northern Power Co.—The *Financial News* states that a meeting of the holders of the 5 per cent. first mortgage 30-year gold bonds is to be held on March 30th, for the purpose of consenting to the company's issuing from time to time the remaining $2,000,000 6 per cent. prior lien 30-year gold bonds.

South London Electric Supply Corporation, Ltd.—The directors have declared the dividend on the 6 per cent. cumulative preference shares for the half-year to April 1st next, payable on that day.

Madras Electric Tramways (1904), Ltd.—The accounts for 1914 show a gross profit of £21,522. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund, there remains a balance of £9,300, plus £3,321 brought forward, making a total of £12,621. A dividend of 6 per cent. per annum on the preference shares absorbs £6,000, a dividend of 5 per cent. per annum on the ordinary shares requires £2,863, there is written off from the cost of issue of new preference shares £500, leaving £3,208 to be carried forward. The traffic receipts show an increase of 3 5 per cent. upon 1913. Down to the end of July the increase was 8 7 per cent., but since that date the receipts have suffered on account of the outbreak of war. As heretofore, the undertaking has been maintained out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund. The reserve arising from the debenture stock sinking fund now amounts to £6,280. Annual meeting, March 23rd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Holders of this company's 6 per cent. bearer bonds are informed that, owing to the situation created by the war, it is almost impossible to get deliveries of suitable material at reasonable prices. The board therefore intend to defer the expenditure on those works for which the money was raised by the issue of 6 per cent. bonds. Consequently, it is proposed to redeem bonds to the value of £10,000, and holders are asked whether they are willing for a portion or the whole of the bonds they hold to be redeemed, plus accrued interest to date. The offer to repay at so early a date is exceptional, as also are the causes which have led to the offer.—*Financier.*

Wycombe (Borough) Electric Light and Power Co., Ltd.—At the annual meeting on 10th inst., the directors reported that further progress had been made during 1914, the connections having risen to 68,306, an increase of 3,056 equivalent 8 C P lamps. Including £169 brought forward, there was a profit to the credit of net revenue account of £6,506, and after paying interest on debentures and outstanding accounts amounting to £3,322, there remained £3,184 available for distribution. A dividend at the rate of 2½ per cent. for the year will absorb £1,000, and £2 000 is to be placed to the reserve fund for renewal account, leaving £184 to be carried forward.

Shawinigan Water and Power Co.—The revenue from all sources for the year 1914 was $1,805,217; the net income, after making provision for operation and interest, was $1,081,347. After paying a dividend at the rate of 6 per cent. for the year, there is transferred to reserve and sinking fund $200,000, to depreciation reserve $100,000, to contingent fund $20,000, and the surplus undistributed is $39,472. The net revenue bears the ratio of 8·6 per cent. to the total outstanding common stock at the end of the year, but the proceeds of the issue of $1,375,000 of common stock were received only in July, 1914.

Wedmore Electric Light Co., Ltd.—At the annual meeting the managing director (Mr. W. G. Burrough), who presided, gave a full report on, and expressed the entire satisfaction of the directors with, the year's working, although they were only able to recommend payment of dividend at 4 per cent. instead of £5 per cent. The set-back was caused by increase in the price of materials for wiring houses, &c., and would not recur. A vote of thanks was passed to the managing director for his voluntary efforts on behalf of the company during the year.

Wemyss and District Tramway Co.—An income of £14,955 shows that the war has not seriously affected receipts, while the management effected economies in several ways. The directors recommend that, out of the profit of £6,819, a dividend of 7½ per cent. be paid on ordinary shares, and 1½ per cent. extra on the 6 per cent. preference shares—7½ per cent. in all—and the balance, £1,580, be carried forward. During the year the doubling of part of the line was completed.

Ontario Power Co. (of Niagara Falls).—The report for 1914 shows total receipts, $1,825,320; net income, $1,398,522; interest, $898,443; surplus, $500,078. Owing to the provisions of the Railway Act of Canada, which are by charter made applicable to the company, the declaration of dividends should be made by the shareholders at the regular annual meeting. The payment of dividends during the year 1915 will not therefore be made in quarterly instalments.—*Financial News.*

Oldham, Ashton and Hyde Electric Tramway, Ltd.—For 1914 the revenue was £33,398, and the expenditure £26,024, leaving a net profit of £7,374, plus £147 brought forward. It is proposed to place to reserve fund £1,000, to pay a dividend at the rate of 6 per cent. per annum on the ordinary shares, and to carry forward £1,021.

Folkestone Electricity Supply Co., Ltd.—For 1914 the directors report a net revenue, including £538 brought forward, of £20,024. After transferring £5,661 to depreciation account and placing £8,500 to reserve, a further dividend of 4 per cent., making 7 per cent. for the year, is recommended, leaving £1,438 to be carried forward.

Liverpool District Lighting Co., Ltd.—After transferring £1,000 to reserve fund, a dividend at the rate of 4 per cent. per annum, less income-tax, is to be paid for the December, 1914, half-year.

Direct Spanish Telegraph Co., Ltd.

The accounts for 1914 show, after providing for interest on, and redemption of, debentures, and for the dividend on the preference shares, a balance of £28,898. The directors consider the opportunity a favourable one for dealing with the question of depreciation on the company's investments which has been progressive for several years, and now amounts to the large sum of £19,212. They therefore propose to apply the balance of £28,898 as follows:—Dividend on the ordinary shares at 4 per cent. per annum £2,586, bonus on ordinary shares of 2 per cent. £1,293, to writing down Stock Exchange securities £19,212, to reserve fund £5,000, and to carry forward £807. Both the dividend and the bonus on the ordinary shares will be paid free of income tax. The £30,000 4½ per cent. first mortgage debentures created in June, 1894, fell due for payment on June 30th last, and were redeemed at that date. To enable this to be done without realising securities at a considerable loss, a loan of £30,000 was obtained from the Eastern Telegraph Co. The Bilbao cable became interrupted on September 23rd last, three knots from the landing place in Cornwall, and the necessary repairs were carried out by the cable steamer *Electra*, the cable being reopened for traffic on September 27th after an interruption of five days. The cost of these repairs, viz., £328, has been charged to revenue.

The annual meeting was held yesterday.

County of London Electric Supply Co., Ltd.

The annual meeting was held on Monday, at Winchester House, E.C. Mr. J. B. Braithwaite, who presided, said that they would remember that at the last meeting he told them they proposed to issue 10,000 additional preference shares of £10 each and 6,000 additional ordinary shares of £10 each, which raised the figure of each denomination of share to £650,000. The issue was made on terms which secured them a premium of £19,000, and they proposed to utilise £5,000 of that sum in writing down preliminary expenses, carrying forward £14,000 as a reserve against any future contingencies that might arise. The issue was over-subscribed and they had every reason to congratulate themselves upon having made it when they did, as after the war broke out it might have been very difficult for them to find the funds they required for the development of the business. On the credit side of the balance sheet there was a considerable increase in the investments. That was due chiefly to the purchase of a block of shares in the South London Electric Supply Co. That was a company whose area adjoined their own, and whose system of supply was also identical with theirs, and it was a company with whom there appeared to be a good opportunity of their working together in closer relations, and it was possible that something might be done in that direction during the present year. The South London Co. had shown considerable progress even this year, when the bulk of the London companies were showing decreases in revenue and in earnings. They had expended a good deal of capital during the past year, but when they saw what the results had been he thought they would say that none of it had been expended unwisely. They had expended altogether £167,916, of which £94,917, or 56.52 per cent. of the total, was for mains. Included in that expenditure on mains was a considerable amount for a new interconnector between their station at City Road and their Wandsworth station. Already they had derived considerable advantage from that inter-connector—the engineer-in-chief telling him that during the first two months of the current year its use had enabled them to secure an economy of 15 per cent. The rest of the expenditure on mains had been made on the lines he had previously indicated. They did not lay mains at random—they only laid them where they would bring them profitable business, and that had been the case this year. In spite of the five months war period which the accounts covered, the earnings had increased from £255,670 to £274,080, an increase of £18,410. £14,000 of that increase was due to increased receipts from sale of current, the balance being made up by increased rentals of meters and increased dividends from their investments, which included the return on the South London Electric Supply Co. shares to which he had referred. They were able to carry to net revenue £164,043 against £147,812, an increase of £16,231. In other words, of the £18,410 gross increase they retained £16,231 as net and available for distribution. In view of the special circumstances which prevailed he thought they would agree that such a result reflected very great credit upon their technical staff; and the increase in the gross revenue reflected equally great credit upon the commercial staff. Out of the net revenue they had placed £40,000 to reserve for depreciation, repairs and renewals, instead of £33,000 as last year; in other words, they were placing an additional £7,000 to that fund, and after doing that they carried forward to the balance sheet £86,841 as against £76,978 last year, or roughly £10,000 more. They had therefore disposed of the increased revenue of £16,000 by placing £7,000 extra to the depreciation fund, they had paid the dividend on the new capital, which had absorbed £4,405, and they proposed to raise the carry forward by £5,458—from £7,000 to £12,500. Even after placing the £7,000 additional to depreciation, raising that allocation to the substantial sum of £40,000, they still earned double the amount required to pay the dividend on the additional capital, which would show them that that capital had been profitably and judiciously expended. They might think that £69,558 was rather a small sum to carry into the balance sheet for depreciation, but he must remind them that that was the balance still available for depreciation, and took no account of the £108,000 which they had already written off that account. With regard to the obsolete plant, he told them last year that they had written off the whole of such plant at City Road. This year they had allocated to the demolition account the whole of the obsolete plant at Wandsworth, and after writing off the sum they had allocated for the present year, there was only £30,000 to the debit of the demolition account; and they had £69,000 left in the account. There were very few companies which were in such a really sound position as regarded their plant as they were. In regard to the business done, in spite of the check caused by the war during the last five months of the year, they had the pleasure of reporting another record in the new business. Last year and the previous year they created a record, and again this year they had a record with new applications of 5,206 kw., which was easily ahead of anything they had secured in any previous year. That reflected the greatest credit upon their commercial staff. It had been obtained by the addition of 1,897 new consumers, bringing the total number of consumers to 24,212, the largest number that any London electric supply company could show. The increase in units sold was 2,269,418, or nearly 9 per cent.; the total sales for the year being just over 28 million units. With regard to the associated companies, the Bournemouth Co. had maintained its dividend at 7 per cent. and the Coatbridge and Airdrie Co. still continued to expand its business, the increase for the past year being the very substantial one of 1,841 kw. The war had prevented the past year from being one of almost phenomenal prosperity with them. They had suffered very severely by the increasing stringency of the lighting restrictions which the Admiralty had imposed upon London and the surrounding districts; but in spite of those restrictions they had progressed to the extent he had indicated. The war had also had a serious effect on their staff; 120 members had responded to the country's call and were serving in H.M. Forces. He was sure the shareholders would approve of the arrangements they had made that those men should not suffer financially in any way. The fact that so many had responded to go to the front had necessarily thrown increased anxiety and strain upon those left behind. He would like to take that opportunity of testifying to the unswerving loyalty and cheerfulness with which those members of the staff who had stayed at home had worked the additional hours and submitted to the additional strain. They would expect him to say a few words about the Parliamentary position. When they met last year he had hopes that common-sense might prevail and that the Bill, of which they were the nominal proprietors, which was put forward by influential bankers, for the unification of the London electric supply, might have had a fair chance of becoming law. He was sorry to say that owing to jealousy nearly all the London companies opposed the Bill, and their opposition reached such a height that the promoters felt it was no use wasting any more money, and they reluctantly withdrew it. It was not their fault that the position of electric supply in London was not now on a satisfactory basis. Their efforts, however, had not been altogether in vain, because this year three Bills had been introduced, one by the L.C.C., which was an exceedingly important Bill which followed almost exactly the same lines as their Bill of last year. The Council had adopted both of the suggestions which they made in their Bill last year. It provided for the acquisition of the companies by the L.C.C. or some statutory body to be created for the purpose, and the leasing back to them of their undertakings for a period of 50 years to be worked by them. It also defined exactly what price the companies should get at the end of the 50 years. They did their best to help the L.C.C. with their Bill, but apparently the incurable jealousies and the smallness of outlook of the London companies caused them to again oppose the Bill, with the result that the Council failed to secure the necessary three-fourths majority to bring it forward, and the Bill had therefore been withdrawn. They had, however, put their hands to the three points which were of the utmost importance to shareholders in the London electric light companies—first that it was a fit and honourable thing that they should have their period of purchase extended to 50 years; second that the best results were to be obtained not by municipal ownership and management but by municipal control and company management; and, third, that it was fair to place the settlement on such a basis that, instead of being dependent upon the result of some arbitration, those who were engaged in the supply of electrical energy to London should know exactly what they were going to get at the end of 50 years' time, so that they might be able to make proper provision for the redemption of their capital. He thought it was a very great gain to have had those principles embodied in a Bill put forward by the L.C.C. Ten of the companies put forward a Bill of their own, and it might come as a surprise to the shareholders when he told them that although those companies threw out the Bill which the County of London Co. promoted last year on the ground that it was foolish to ask the L.C.C. for 50 years, the associated companies had adopted that proposal in their Bill. The companies, apparently, could not agree among themselves, and their Bill had been withdrawn too. As far as the

directors of the County of London Co. were concerned, they did not intend to allow the question to rest where it was. They had a very clear view as to what was the proper policy to pursue, and they proposed to forward the unification of the electric supply of London by every means in their power. He had already alluded to a possibility of their coming into closer working relations with the South London Co. They had acquired a very large area in the Romford district and they proposed to go forward with the lighting there, and by next year he hoped to be able to tell them that they had commenced a supply there; and step by step they proposed as opportunity offered to follow up their policy of doing their utmost to unify the supply, and place the electric supply of London, as far as they had power to do it, on a satisfactory and sound commercial basis. The outlook for the current year was the most difficult matter that confronted him. We were in the middle of a great war, and none of them knew when it was going to end. At the present time conditions were somewhat unfavourable for electric supply companies owing to the dislocation in coal prices and other difficulties. They would do the best they possibly could to meet those conditions. Both the gas companies in London had increased their prices, and, although they would do it reluctantly, it might be necessary for them to ask some of their customers to share with them the burden of the excessive cost of coal while the war lasted. If they found it necessary they would do that in order to protect the interests of the shareholders, and he had no doubt that the consumers would regard any increase in the price of current as part of the sacrifice which they would have to bear in order to carry on the war. He was glad to say that up to date the applications for new business were slightly in excess of those up to the corresponding period last year, and the units sold had increased by 4 per cent.

Mr. F. W. Reynolds seconded the motion.

Mr. J. J. Bisgood congratulated the board upon the report and also in regard to their policy for unifying the supply of electricity to London. No matter what happened in the future, it would always stand to the credit of the board of that company that they suggested a solution of that great problem.

The report was adopted.

Metropolitan Electric Supply Co., Ltd.

Mr. W. Harrison Cripps presided on Tuesday, at Winchester House, E.C., over the annual meeting of this company. After reviewing the finances as given in the report, he said that in regard to the capital expenditure, the money was raised partly by a further issue of their 3½ per cent. debentures and partly against the reserve fund. It was spent partly upon generating and distributing plant and partly in providing connections for new consumers. At Willesden, in addition to minor improvements, they had installed a new 4,000-kw. Parsons turbine. They had had nine months' experience of this machine and found that it was saving them a large amount in coal, water and oil, thus materially reducing their running costs. It was working in the most satisfactory way. They had also bought some freehold land in the Holborn district and had erected a building to accommodate large storage batteries, the effect of which would be to save the generation of many kilowatts at Willesden on the peak load. During the last few years they had been making considerable additions to their reserve fund: thus during the three years 1908 to 1910 they placed £15,000 annually to reserve. In 1911 this was increased to £17,000, in 1912 to £20,000, and in 1913 to £22,000. This year they proposed making a similar addition to the fund. He would remind them that when they had Marylebone, and their generating station at Sardinia Street, considerable sums had been put aside against the depreciation of those properties for which they received under the two arbitrations payment in full, using the money they obtained in buying new plant for the remaining parts of their undertaking. These reserves thus became available to increase the amounts set aside in respect of the remaining plant, much of which had been acquired within the last twelve years. If the past year had been a normal one the position of the company, judging from the results of the first six months, would have been quite satisfactory, but the year was not a normal one. When they made up their accounts in July for the first six months there was a satisfactory increase both in new business and receipts, the result showing a satisfactory margin over costs. The actual number of new customers in the year was 1,620. The increased connections had been 1,550 kw., or an equivalent of 50,000 25-c.p. lamps. This was practically as good a progress as they had made in any one year. The new connections were at present coming in at a favourable rate. In spite of the war they were in excess of the corresponding period of the previous year. In August, like a bolt from the blue, the war was upon them, upsetting every calculation. They soon had difficulty in keeping up their coal reserves and the prices began to rise. They had to part suddenly with some of their most experienced workmen: they had also to make provision for guarding their works and the exposed portions of their mains, and it at once became evident that their expenditure during the last half of the year would be increased. When October arrived a new unforeseen loss of revenue had to be faced. They must bear in mind that, owing to the situation of their undertakings, chiefly in the West of London, the main source of income was from the sale of light, and October, November and December were the most important and profitable months for selling light; indeed, as much light was consumed during these three months as was the case in the six summer months of the year. Just as this important period commenced the order came for reducing all light to a minimum. They did not complain of this. They supposed it was necessary, but the shareholders had had to sacrifice a considerable part of their income for the general safety of London. To show the effect of this, he might mention that the revenue for lighting in their London areas decreased by over £10,000 in the last quarter of the year. The reason why the net decrease was no greater than about £2,000 was due to the large amount of new business they had been able to secure in the western areas. He only gave this as an explanation for the fall in revenue, which was in no way due to any permanent diminution of their business. It was one of the incidents of the great war. How long it would last who could tell, but sooner or later it would pass, and he hoped that the trade and prosperity of the country, upon which the electric supply industry depended, would have a quick and vigorous revival. During the past year an attempt had again been made to consolidate the electric supply of London. The Bill which the London County Council was to introduce failed owing to it not obtaining the necessary two-thirds majority of the whole Council. Most of the companies, subject to the settlement of certain details, were not necessarily in opposition to the Council scheme, the essential of which was the purchase by agreement by a new authority of the present companies of London. The new authority was to delegate its powers, safeguarded in many respects, to a new company to take over the actual working of the undertaking. The companies, failing any satisfactory agreement with the London County Council, had a Bill of their own to effect a combination of the majority of the present undertakings. This Bill was to provide for the alteration of the present terms of life and to place the future purchase of the undertakings on a more satisfactory footing. These two Bills, with certain modifications, were not inconsistent with each other, but their Bill had had to be withdrawn in deference to the views expressed by the Chairman of Ways and Means that no private business of such magnitude should be undertaken during the present session. They believed that a proper combination of the present companies would reduce costs and would ultimately be an advantage to the consumers of electricity. They did not regard the matter as dropped, but merely postponed to a more favourable season. The year had been an anxious one to their staff, and had entailed much extra work. The directors wished to thank them all for what they had done, and would especially mention their two chief officers, Mr. Highfield, the engineer and manager, and Mr. Cunliffe Owen, the secretary, for the zeal and devotion which they, with other members of the staff, had shown in the interests of the company during this very trying period. No less than 58 of their employés responded to the first call and were now away at the front. If these men served their country with the same faithfulness that many of them for years past had served the company the British Army would contain no finer body of men, and they knew that when they returned it would be with honour to themselves and their country. He wished to speak well of those who still remained in their service. Many of these also would have liked to have joined, but the board felt that they were equally doing their duty by their work in keeping up a regular supply of electricity, one of the most essential necessaries for London at the present time. They could not let their men leave them for the war without doing something towards the support of their families during their absence. The directors had made some provision for this.

Sir J. Pender, Bart., seconded the motion.

Mr. H. L. Cripps expressed his approval of the Chairman's statement that it was intended to proceed with the Bill for amalgamation when the time was opportune. He felt great confidence that amongst all the business men of the London County Council, no matter what their politics might be, there was a very strong feeling in favour of the policy which the Chairman had indicated, and which had been expressed in their own Bill.

The report was adopted.

Braunton Electric Light and Power Co., Ltd.

At the annual meeting recently held it was reported that the net revenue account showed a balance of £238. The directors recommended a dividend of 5 per cent (less income tax) on the cum. pref. shares, amounting to £23, a dividend of 2½ per cent. on the ordinary shares (less tax) £63, writing off a further £80 from formation expenses, and 5 per cent. for depreciation of machinery, plant and accumulators, and 2 per cent. off mains, cables and services, amounting to £100, leaving £22 to be carried forward. The net revenue account showed that £234 was yielded from private lighting supplies, £77 from contract lighting, and £50 from contract pumping.

Mr. Yeo, who presided, gave figures showing the advance made annually since the company was inaugurated a few years ago, and considered the position of the undertaking most satisfactory.

Electrical and Industrial Investment Co., Ltd.

An extraordinary general meeting was held on Monday at Electrical Federation Offices, Kingsway, under the presidency of Mr. E. Garcke, when the Chairman formally proposed the following resolution for reducing the capital of the company:—

That the capital of the company be reduced from £400,000 divided into 200,000 six per cent. cumulative preference shares of £1 each, 100,000 of which have been issued and are fully paid, 100,000 issued and fully paid seven per cent. preferred ordinary shares of £1 each, and 100,000 deferred ordinary shares of £1 each, 90,000 of which have been issued and are fully paid, to £314,500, divided into 200,000 six per cent. cumulative preference shares of £1 each, of which 100,000 have been issued and are fully paid, 110,000 seven per cent. preferred ordinary shares of £1 each, of which 100,000 have been issued and are fully paid, and 90,000 deferred ordinary shares of 1s. each, all of which have been issued and are fully paid, and that such reduction be effected by cancelling capital which is lost, or is unrepresented by available assets to the extent of 19s. per share upon each of the 90,000 fully paid deferred ordinary shares of £1 each, which have been issued and are now outstanding, by reducing the nominal amount of each of such shares to 1s., and by converting the 10,000 unissued deferred ordinary shares of £1 each into 10,000 unissued preferred ordinary shares of £1 each.

Mr. Garcke remarked that he fully explained the reasons for the resolution at the recent annual meeting, and he might say that while they had not received a single proxy against the proposal they had received a large number in favour of it.

Mr. Cunningham seconded the resolution, and it was carried.

Subsequently a similar resolution was passed by the holders of the deferred ordinary shares of the company.

South London Electric Supply Corporation, Ltd.

The gross receipts for the year 1914 were £55,030, while the expenditure was £25,431, leaving £29,599, plus £728 brought forward. After placing to depreciation account £5,416 (making the fund £50,000) and writing off special items capital account £978, also making provision for the dividend on 6 per cent. cum. pref. shares due October 1st last, and accrued to the end of the year 1914, debenture and other interest accrued, etc. £14,428, there remains £15,899. Out of this the board recommend a dividend on the ordinary shares at the rate of 5 per cent. for the year, amounting to £13,000, carrying forward £2,899. During the year new connections representing the equivalent of 38,742 (35 watt) lamps, or 1,355 kw., were added to the company's system, making a total connection at the end of the year of 340,866 (35 watt) lamps, the equivalent of 11,900 kw. The units sold during the year amount to 6,153,241, and show an increase of 412,015 or 7.2 per cent. over the previous year. The ratio of total costs to revenue is 46.2 per cent. The plant, machinery and mains have been maintained out of revenue in an efficient condition. The report refers to the position of the two London Electric Supply Bills which are not to be proceeded with at present.

Units generated	7,669,760
Sold to consumers and used by public arc lamps	6,153,241
Used on works for lighting, meter testing, and motors ...	414,960
Total	6,568,201
Expended in distribution	1,101,559
Total connections	11,900 kw.

Annual meeting, March 23rd.

Salisbury Electric Light and Supply Co., Ltd.

The report for 1914 states that the generating plant has been sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £1,098 brought forward, amounts to £6,994, and after paying £1,044 interest on debentures and an interim dividend at the rate of 4 per cent. for the half-year, amounting to £700, there remains £5,250. The directors recommend that a further dividend at the rate of 8 per cent. for the half-year be paid, making with the interim dividend, 6 per cent for the year, and that £2,400 be carried to reserve, leaving £1,450 to be carried forward.

Mr. F. E. Gripper presided at the annual meeting, held on March 9th. He first referred to the death of the Chairman, Mr. W. M. Hammick, who was practically the founder of the company. They were hoping to induce Mr. Woodrow, a Salisbury man, to become chairman. The company had had quite a good year. In spite of war troubles and the great difficulty there had been in the matter of coal transit, it had been the most successful year they had had. The staff had responded extremely well to the call of their country in joining the colours. At the commencement of the war they had 29 members of the staff, and 30 per cent. of those were now serving with the colours. The company had made arrangements to give those men a generous allowance during the time they were away, and were reserving their positions as far as it was possible to do so. There had been a considerable amount of economy in lighting since the war began, and that had reduced the amount of current which would have been used under ordinary circumstances. In spite of that, their receipts on the revenue account were £138 larger than last year, while the costs of running were only £88 more, about half of that amount being due to the increased cost of coal. Altogether they had £352 more to deal with than they had last year. They thought it advisable, under present conditions, to carry forward a substantial amount, so that they might have provision for any trouble that might turn up. But for the existing conditions he thought the directors would have been justified in paying another 1 per cent., but the more prudent course was not to increase the dividend this year and to live in hopes of being able to do so next year. The company was in a very sound financial position.

Mr. A. C. Bothams seconded, and the report was adopted.

The Chairman mentioned that the directors had elected Mr. J. C. Wigham, one of the representatives of Messrs. Edmundson, to fill the vacancy on the board caused by the death of Mr. Hammick.

Brompton and Kensington Electricity Supply Co., Ltd.

The revenue account for 1914 shows a credit balance of £30,271, plus £7,153 brought forward, and £322 balance of interest received and accrued, making a total of £37,746. After deducting £1,273 for interim dividend on the 7 per cent. cum. pref. shares, and £7,360 interim dividend (free of income tax) at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that £29,114 be dealt with as follows:—Written off cost of investments £1,100, written off the shares in and advances to the Brompton and Kensington Accessories Co., Ltd., £4,000, reserve fund account (raising it to £46,000) £6,500, dividend on the preference shares for December half-year £1,052, dividend on the ordinary shares for December half-year at the rate of 11 per cent. per annum, making 10 per cent. for the year, £9,315, income tax on interim dividend £521, directors' additional remuneration £1,000, leaving to be carried forward £5,626.

Year.	8-c.p. lamps connected.	Inc. in 8-c.p. lamps.	Customers connected.	Gross receipts.	Expenditure	Net receipts.	Av. price per unit.	Div. on ord. shares.
1912	272,701	13,147	5,799	£56,848	£23,170	£33,178	4·18d.	10%
1913	291,108	18,407	6,118	£56,484	£24,984	£31,500	4·08d.	10%
1914	310,238	19,130	6,350	£56,370	£26,099	£30,271	3·92d.	10%

The annual meeting was held yesterday.

Edison Accumulators, Ltd.

Mr. Bernard M. Drake, M.I.E.E., presided on Friday, at 2, Duke Street, S.W., over the first annual meeting.

The Chairman, in moving the adoption of the report, said the results shown in the balance sheet were fairly satisfactory, due allowance being made for the abnormal times through which they were passing. The item under the profit and loss account for staff, offices, and selling expenses might appear high, but they would understand that in initiating the industry of the company, which was new to this country, it was necessary to be constantly running cars for demonstration purposes, and enquiries had to be followed up closely so as to educate the public as to the results which might be expected under various working conditions, and the particular ones for which their products were best suited. It had also been necessary to prepare special designs to suit the conditions prevailing in England, which in many cases were different to those in America and elsewhere. They would notice amongst the assets an item of £4,845 under the heading of "royalties paid in advance." He might explain that in order to obtain the concession for the sole rights of the Edison battery for England a sum of about £5,000 had to be paid in advance. This amount, however, was being credited to the company on orders as placed with the Edison Co. of America. For part of the period under review they were unfortunately paying for two sets of offices; their former offices, however, had now been let, so that this extra outlay would not recur. At the end of the year there were sufficient unexecuted orders on the books to have enabled them to show a profit had it been possible to obtain the necessary equipment in time. As regarded the future, they would be pleased to hear that encouraging reports were being received concerning the results obtained with the vehicles now at work. Not only was the cost per ton-mile comparing very favourably with that of other road transport systems, but the reliability, ease of manipulation, and quiet running of the Edison accumulator vehicles were proved to be advantages with which no other system could hope to compete. An objection sometimes raised to the use of electric vehicles was the trouble of recharging and the time occupied in this operation. This, however, would largely disappear with increasing use and additional charging stations. One special feature of the Edison battery was the rapidity with which it could be recharged. Another important point with regard to the working of electrically propelled vehicles was that the cost of generating and supplying current was steadily decreasing, whereas the cost of petrol or other fuel for the internal-combustion engined commercial and private cars had been continuously rising. To give them a practical example, he might mention that one Borough Council engineer had found that four 2-ton tipping wagons had replaced no less than 11 horses and carts, besides doing the work of refuse collection more efficiently. Although the first cost was heavier, it was claimed for the Edison battery that being composed of more durable materials it could successfully withstand vibra-

tions and hard work which would shorten the life of lead batteries, so that in the end the cost for traction work would be lower. The life of a lead battery was now pretty accurately known, and was short, but the life of the Edison battery, judging from examinations of batteries which had been in use and showed no deterioration whatever, would be indefinitely long. The Edison battery had also a very distinct advantage in that it suffered no deterioration from being completely discharged, or even left in a discharged condition, a state of affairs which was very prejudicial to lead batteries. Mr. Edison was reported to have said that in his opinion the nickel iron alkali battery would play an important part in the transportation of the future. This statement was already verified in America, but in England they were slow to move in anything new, and it was often difficult to overcome the want of enterprise shown by the older established stores, cartage contractors, and other firms, who were content to wait until their more up-to-date competitors had shown what could be done. Arrangements had been concluded with the firm of Drake and Gorham, Ltd., of which he was chairman, under which their widely-spread organisation would be available for pushing the sale of Edison vehicles, especially in Lancashire and Cheshire, for which district they had purchased a two-ton truck which was constantly employed in making demonstrations. He was glad to say that the orders received since the expiration of the period covered by the balance sheet had been most satisfactory, in fact they amounted to over three-fifths of the total during the period covered by their balance sheet. He had every hope, therefore, that when next they met the directors might be in a position to recommend the payment of a good dividend.

Col. H. C. L. Holden seconded the motion.

A shareholder remarked that the statement was most encouraging, and he hoped the board would be in no hurry to pay dividends.

The Chairman said that was advice they rarely received from shareholders.

The report was adopted.

Oxford Electric Co., Ltd.

Sir Henry Mance presided at the annual meeting, held at Oxford on March 5th. The Secretary (Mr. H. Eeles) read the Chairman's financial memorandum, which showed that the capital expenditure was less by £4,623 than for 1913. In the revenue account the expenses were adversely affected by increased price of commodities, increased taxes, and heavier wages, due to the war. The revenue had increased by £400. The item of street lighting showed a decrease, as the account had been charged with the cost of providing a system of incandescent lighting to take the place of the large arc lamps which were extinguished some weeks ago. Cost of carbons had largely increased owing to shortage of imports. The balance of gross profit was less by about £500, approximately ¼ per cent. on the ordinary share capital. The Chief Engineer (Mr. F. H. Francis) read a report on the engineering work of the year, plant alterations, mains extensions, new installations, etc. There seemed to be a growing demand for 2 and 3-h.p. motors for such work as boot-repairing, firewood making, etc. In regard to new services, 1913 was an exceptionally good year, and but for the war they would probably have broken the record in 1914. The price of coal had increased nearly 4 per cent., and fuel oil for the Diesel engine by 31 per cent. They were deprived of the use of the Diesel engine for a considerable period in consequence of an accident in September. It was now in use again, but with a reduced output. The repair of the third cylinder, the one severely damaged by the accident, was now under consideration, and would be taken in hand as soon as possible. Their present stock of coal would last eleven weeks, and with the assistance of the Diesel engine three months. The prospects for lower prices of fuel were not encouraging.

Sir Henry Mance, in the course of his address, said that he had taken the view that in this period of great national stress, when investors would be disappointed in many of their sources of income, it was their duty to pay to the shareholders every shilling they could which had been fairly earned and which they could prudently do. They would continue to act on that policy. They were doing remarkably well when the war broke out and looked like having a revenue £1,000 in excess of the previous year, but they were affected by the colleges and allied institutions needing less current, and by the prohibition of private outside lighting. Personally, he believed that the citizens of Oxford were in greater danger during a thunderstorm than they would be from the visit of a hostile aeroplane. Some of the staff had volunteered to do the duty of one of the employés who was at the front, by means of overtime, for which they asked no extra remuneration. The issue of preference shares made last month had been several times oversubscribed for. The shares were offered to the shareholders a few days before the Treasury minute appeared. He saw one of the Secretaries to the Treasury and was informed that there was no objection to the issue, but it would be necessary to communicate with the Treasury when they applied for a Stock Exchange quotation. Sir Henry said that he did not suppose that the most sanguine amongst them anticipated that the war would be over before the autumn, and that being so they must not expect any increased demand for current on the part of the colleges and allied institutions. Still, if they were to put the question to him, "were they downhearted?" he would reply emphatically "No!"

The report was adopted.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting was held in Newcastle-on-Tyne on the 10th instant. Mr. E. L. Pease, who presided, said that Dr. Simpson (the Chairman) and Mr. F. S. Newall were prevented by illness from being there that day. The capital expenditure on buildings, generating plant and machinery totalled £273,994, which was nearly £3,000 less than last year. The reduction was due to one of their customers having exercised his option to purchase some electric motors and other plant which that company had supplied on hire-purchase terms. The value of the plant sold under the agreement was £3,922, but on the other hand they had paid on capital account during the year £980. The profits for the year were £39,001, an increase of £756 over the previous year, and they were transferring an extra £1,000 to the reserve fund. The profits available for distribution were £40,611, as compared with £37,710. Since the outbreak of war there had been a slight decrease in the amount of waste heat obtained at some of the stations; compared with the corresponding period of the previous year, it represented in units of electricity about 7 per cent reduction. This did not mean, of course, that the company's profits during that period had necessarily decreased to that extent, as a large part of the revenue was received in the form of fixed charges which were paid by the electric power companies for the use of the stations. He would not venture to give any forecast as to the probable results of this year. The company's supplies of waste heat and gas depended largely upon the regular working of coke ovens and blast-furnaces, and if those businesses were seriously affected by the war they would themselves be affected also. The company had not erected any new generating stations since the last report, but the directors had had recently under consideration the advisability of installing some additional plant at Weardale power station, in view of a more efficient utilisation of the gas received from the coke ovens, and they had also made arrangements to erect some further plant at the company's Grangetown power station with the object of maintaining greater output from the plant installed there. If those works were carried out it was estimated that they would involve an expenditure of £35,000 to £40,000, which would be within the company's available cash resources.

The report was adopted.

It was decided to distribute £1,000 amongst various relief funds.

Chelsea Electricity Supply Co., Ltd.

In the absence of Mr. Davies, who is on service with the Red Cross in France, Major W. F. Woods presided on March 11th, at Winchester House, E.C., over the annual meeting. He said that during the part of the year previous to the declaration of war, the number of units generated and sold showed a very satisfactory increase, and revenue was growing steadily, but in the latter part of the year the restrictions imposed on street lighting had caused a considerable shrinkage in the sale of current, attributable to the reduction of the lighting of shops and other outside illumination, the earlier closing of licensed premises, the cessation of most forms of entertainment, and the general practice of economy in businesses and households. In the first half of the year there was an increase of 40,932 in the units sold, or an increase of about 2 per cent., as compared with the first half of 1913, but by the end of the year this was converted into a decrease of 108,983 units, or about 2¼ per cent., as compared with the previous year. Added to this, the increased price of coal, which was from 25 to 30 per cent higher than before the commencement of the war, coupled with the difficulty of obtaining regular supplies owing to the dislocation of traffic on the railway systems, caused the directors to prepare them for a possible falling off in the net profits in 1915. Unfortunately, the immediate outlook, so far as coal prices were concerned, were not encouraging, but the Government were now taking steps to give electricity supply undertakings assistance in deliveries, and they hoped to reduce the expenditure by using more oil fuel in connection with the Diesel plant. Notwithstanding the adverse circumstances, the receipts and expenditure were practically the same as in 1913, and the net amount available for distribution after payment of interim dividends and debenture interest was £29,058. There was considerable delay in getting their Diesel plant to work. It was still in the hands of the contractors, and certain questions with them were still outstanding. The engines had, however, been at work during the latter part of 1914, and they believed that their anticipations in regard to their effect in reducing the fuel costs would be fully justified. They proposed to utilise this portion of the plant to a considerable extent during the current year. The amount paid to the Central Co. for current purchased had been £1,077, as against £641 in 1913. The increase in 30-watt connections during the year was 7,854, and but for the untimely circumstances of the war this item would doubtless have been considerably increased. In regard to the London power Bills, now withdrawn, whatever might happen in this connection in the

future, the directors might be relied upon to see that the interests of the Chelsea Co. were properly safeguarded, and the shareholders would, of course, be asked for their approval of any scheme by the companies dealing with this very difficult question. The directors had interested themselves in the question of recruiting men for the Army and personally interviewed all members of the staff who had not previously enlisted, and who were eligible for service, to ascertain (without, however, bringing any pressure to bear) whether there were good reasons for their abstention. He was glad to report that 34 men out of 122 had joined the colours, or more than 25 per cent. of the staff. The directors had made provision for their dependents with a promise of reinstatement on return. The thanks of the shareholders were due to all those members of both the indoor and outdoor staff who, during a very difficult time, had loyally carried on the work of the company. He also expressed their gratitude to the police, and especially to the special constables, who had given their ungrudging services during the dark hours of the night, and often during the most inclement and unpleasant weather, for the protection of the company's stations.

Mr. H. E. Beeton seconded the motion, and the report was adopted without discussion.

Mr. S. Beeton was re-elected a director, and a vote of thanks was passed to the special constables for their services in guarding the company's properties.

Derby Lamp Works, Ltd.

At the statutory meeting, held at Moorgate Place on March 12th, it was stated, according to a report which has been supplied to us by the secretaries, that the number of preference shares applied for fully reached expectations and practically 50 per cent. of the ordinary shares offered as 3s. 6d. paid had been applied for, and shareholders of Metalite, Ltd., were congratulated on having exercised their rights to such a substantial extent. They had purchased a few new machines, principally labour-saving devices, which the works manager thought desirable. They were selling some of the machinery which, owing to their not making filaments, was now unnecessary. They had invested £250 in the Sheraton Glass Manufacturing Co. in order that they might secure a constant supply of bulbs at minimum cost. They went to allotment on January 15th with a clear working capital of £7,000. This was a satisfactory result considering the financial difficulties consequent upon the war. Finance once satisfactorily arranged, said the Chairman, the present state of affairs undoubtedly militated in their favour; they could not have started business at a more favourable time—a time when their enemy competitors were entirely shut out of the market. After the war, Austrian and German manufacturers who in the past had found this country such a convenient dumping ground, would find that the energy and initiative of the British lamp makers had "changed all that." The speaker went on to refer to the management, which he confidently believed was going to make "our company not only successful, but one of the foremost lamp factories in this country." The works manager, Mr. J. L. Green, "has had an experience of which many in this trade may well be envious." "Although we only went to allotment two months ago we already have a satisfactory production, and what is at this stage perhaps the most important point, we are satisfied that the lamps we are producing are second to none in quality." This "rapid progress" however would hardly have been possible if the directors had not financed the company out of their own pockets for over two months before allotment. Those who were shareholders in Metalite, Ltd., were under a considerable obligation to them in that respect.

We are informed that in reply to questions which were asked, the directors stated that they were satisfied that the working capital available was sufficient to bring the company to a paying basis, and that they had been offered a contract for the whole output, also one for 20,000 lamps per week. These contracts were under consideration.

STOCKS AND SHARES.

The recovery in markets to which we alluded last week is continuing steadily. Although in Consols there is still no chance of realising stock, for most of the other gilt-edged securities a demand is distinctly noticeable. This investment enquiry has the virtue of spreading, and, for the first time in many months, we are in the position of being able to record that buyers are searching the electric lighting list for what they consider to be cheap shares. The Home Railway group is decidedly better.

What is known as the Miscellaneous market, wherein are comprised most groups of industrial securities, is the most active in the Stock Exchange; and of all its varied sections, that for oil is pre-eminently strong. One of the main features of the week turned out to be a further sharp advance in the price of Marconis, though the movement lacked sufficient staying power to hold the quotation at the best level reached.

The especial point that makes the electric lighting market noteworthy is the fact that a number of the shares which hitherto have been practically unsaleable at their quoted levels can now be realised without difficulty. The change would be remarkable were it not remembered that, under the restrictions imposed by the Government, Stock Exchange jobbers are not allowed to sell shares unless they have actually got them. One direct consequence of this is that, whereas in the ordinary way they would sell, taking a business risk of replacing the shares at an early opportunity, they cannot do so unless armed either with the shares themselves or with the positive knowledge that they (the jobbers) can get them. And as, in market circumstances so unique as those at present ruling, the timid buyer is frightened when he finds his chance of acquiring cheap stock looks like becoming practicable, so also the hitherto anxious seller no sooner gets a bid for his shares than he promptly raises his price, in the hope of getting more.

If in this exposition of circumstances there savours aught approaching the iteration regarded by good authorities as so damnable, the writer on Stock Exchange topics must fain cover his defence with the statement that the aforesaid set of conditions comes into play so frequently, and yet so unexpectedly, that he is compelled to fall back upon it in endeavouring to set the market picture clearly before those interested in its view.

Within the next two or three weeks all the electricity supply shares will be quoted ex-dividend, and it will be possible to reinstate that table of yields on money invested which previously, since war broke out, might have given a false impression instead of a correct one. The quotations below are mostly cum dividend, allowing for which, the leading ordinary shares can be bought to pay 5½ to 6½ per cent. on the money. The trouble, as hinted above, is to secure shares; and in cases where only a month ago there were blocks up to 500 on offer, to-day's investor will learn from his broker that, if he is fortunate, he may be able to secure 100 at some comparatively high price. In addition to the following prices, we may add that bargains were done to-day (Tuesday) in South Metropolitans at 9s. 9d., and in Bournemouth Ordinary at 10⅛.

We append our usual list of representative stocks and shares in the electric lighting markets:—

Home Electricity Companies.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	5⅛	4⅛ xd	—
do. do. do. 4½ Pref.	4⅝	4⅝	—
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91⅞	90	—
Chelsea	4⅝	4⅝	—
do. 4½ Deb.	96⅛	92	—
City of London	16	14⅜	+ ⅛
do. do. 6 per cent. Pref.	13⅛	12⅝	—
do. do. 5 Deb.	116⅛	112	—
do. do. 4½ Deb.	100⅛	98	—
County of London	12	11⅜	+ ⅛
do. do. 6 per cent. Pref.	12	11⅜	+ ⅛
do. do. 1st Deb.	102⅛	99	—
do. do. 2nd Deb.	100⅛	97	—
Kensington Ordinary	7⅛	7 xd	—
London Electric	1⅞	1⅝ xd	+ ⅛
do. do. 6 per cent. Pref.	5⅞	5 xd	—
do. do. 4 Deb.	92⅛	87	—
Metropolitan	8⅛	8⅛	—
do. 4½ per cent. Pref.	4⅞	4	—
do. 4½ Deb.	97⅝	96	—
do. 3½ Deb.	83	80	—
St. James' and Pall Mall	9⅜	9 xd	—
do. do. do. 7 per cent. Pref.	7	6⅜	—
do. do. do. 3½ Deb.	84½	80	—
South London	3⅛	3	—
South Metropolitan Pref.	1⅜	1⅛	—
Westminster Ordinary	8⅜	7½	— ½
do. 4½ Pref.	6⅜	4⅜	—

Telegraphs and Telephones.

Anglo-Am. Tel. Pf.	108½	108½ xd	—
do. Def.	23	21½ xd	—
Chile Telephone	7⅜	6⅜	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16⅜	15⅜	—
Eastern Extension	12⅜	12⅜	—
do. 4 Deb.	97⅛	92 xd	—
Eastern Tel. Ord.	130½	128½	+1½
do. 3½ Pf.	77⅛	74	+1
do. 4 Deb.	96⅛	94	—
Globe Tel. and T. Ord.	11½	11	—
do. Pf.	12⅞	11⅞	+ ⅛
Gt. Northern Tel.	32½	29	+1
Indo-European	59	51	—
Marconi	1⅜	1⅜	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2⅜	2	—
do. Pf.	1⅝	1⅝	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1½	1⅝	—
Western Telegraph	13⅜	13½	+ ⅛
do. 4 Deb.	96½	94	—1½

Foreign Trams, &c.

Anglo-Arg. Trams, First Pf.	4⅜	4⅛	—
do. 2nd Pf.	4⅛	3⅞	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98⅛	92	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	52⅜	— ⅛
Bombay Electric Pf.	11⅜	10⅜	—
do. 4½ Deb.	96	91	—
Mexico Trams.	70	35	—
do. 5 per cent. Bonds	84	50	—10
do. 6 per cent. Bonds	76	30	—10
Adelaide Sup. 6 per cent. Pf.	6½	6⅛ xd	—
do. 5 Deb.	104	103	—

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Home Rails.			
Central London, Ord. Assented	83	76	—
Metropolitan	57½	30	+1
do. District	21⅝	17⅝	+ ⅛
Underground Electric Ordinary	2⅝	1⅛	+ ⅛
do. "A"	7/8	6/-	—
Income	88	61 xd	+ ½
Manufacturing Companies.			
British Westinghouse Pref.	1⅝	1⅝	—
do. 4 Deb.	74½	72	—
do. 6 p. llen	102½	99	—
Callenders	11⅞	11⅜	—
do. 5 Pref.	5½	4¾	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3-16	—
Edison & Swan, £3 pd.	⅝	14/6½	—
do. do. fully paid	1¼	2¼	—
do. do. 4 Deb.	59	65	—
do. do. 5 % Deb.	63½	60	—
Electric Construction	1¼	13/6	+ 6d.
do. do. Pf.	⅞	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14½	+ ½
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8⅞	—
Telegraph Con.	88½	87½	—

One of the features in the Home Railway market is a point rise in Metropolitan Consolidated stock. The chairman at the recent meeting was mildly bullish, and he went quite frankly into the question of the Government's obligation with regard to making up the traffic receipts. What the Government guaranteed was a certain income from certain sources, reduced through the carriage of troop trains. The Government had not guaranteed their net income out of which the dividend was paid, and it therefore followed that they had not guaranteed the dividend itself. The price of the stock has risen to 30. Surplus Lands are higher at 56. Districts are 10s. better at 17½. Underground Electric income bonds have progressed still further towards recovery of the full amount of the recent £3 deducted for the dividend. Central Londons are steady. There is even a little business in East London ordinary stock, on the basis of 3¾. It may be recalled, incidentally, that the price of East Londons at the time war broke out was 5½.

Brazilian Tractions have been fluctuating within comparatively narrow limits round about 53. The exchange from Rio rose to 13⅜d. at the end of last week, and later came back to the neighbourhood of 13d. The company continues to declare its quarterly dividends of 1½ per cent.—that is, at the rate of 6 per cent. per annum; and although there are qualms as to its retention, which make the price somewhat wobbly every three months as the declaration date draws near, the speculative investor is manfully buying shares which, so long as the existing payments continue, give him the handsome return of 11¼ per cent. on his money.

Marconis touched 39s., a fresh advance of 2s. 3d., but the effort met with large sales of pre-moratorium shares, and this took the price back again to 36s. 3d. Holders who had been running Marconis just before war broke out were allowed, under the Government's scheme, to keep them in suspense at 38s. 9d. so long as that price was not reached, but on shares becoming saleable at 1 15/16, the bulls could be called upon either to pay for the stock or else sell it. So many selling limits were fixed at the price mentioned that the recent buyers became exhausted before the sellers did. Market theory contends that while the Marconi Company is under Government control, the Treasury will recoup whatever loss the undertaking may be put to by reason of naval and military exigencies.

The Consolidated Gas & Electric Co. of Baltimore, very familiar to investors over here, is about to issue Two-year 5 per cent. Notes at 98, with conversion privileges into common stock at 115. Out of this issue arises the rather important question whether the British investor will be allowed to participate, supposing the Treasury decline to allow the stock to be offered here at all. Some weeks ago, official prohibition was applied to a bond-offer by a first-class American Railroad, but if the Baltimore Co. chooses to allot its Notes by way of rights, the patriot may well be puzzled in his search for some method whereby the British investor is to be debarred from subscription.

Mexico Tramways bonds have gone back 10 points in each class, for reasons too hopelessly well known to call for comment. Other than these, the changes are not large enough to quote. As a curiosity may be mentioned the record of transactions in Kalgoorlie Electric Lighting ordinary shares at threepence; the preference mark 4s. 6d.

The Telegraph market is generally steady, with the Eastern group in the ascendant. Eastern ordinary put on 1½, the preference a point, and Globe preference ½. Westerns were a better market at 13¼, Great Northerns gained £1. We have already pointed out that investment demand has penetrated this section, and that the difficulty is not to sell shares, but to buy them at anything like the quoted prices.

The Manufacturing list is firm, holding its rises of the past week or two. Electric Constructions advanced a little, and Henleys at 14½ are the fraction up. British Westinghouse preference rose to 39s. 6d., at which price sellers came in and reduced it to its former level of 38s. 9d. Armament shares are decidedly weaker. Lord Kitchener's speech on Monday night foreshadowed a Government scheme for enabling employés of large contracting firms to share in whatever of extra benefit such firms derive from the war. As it had already been assumed in the market that the armament companies were scarcely likely to raise their dividends next month, this announcement by the Minister of War did not stimulate prices. The rubber market, on the other hand, is good, with a number of the best-class shares in such demand as to lead daily to better prices.

Interesting points have arisen in connection with certain of the Government telephone contracts in respect of private lines between the Stock Exchanges of London and the provinces. The Government took over the lines altogether when war broke out, and for about six months the brokers had to rely on trunk calls. Now the Post Office offers to cancel the remainder of whatever contracts may be outstanding, or, alternatively, to continue them at a reduction of 33 per cent., in view of the shrinkage of Stock Exchange business caused by the Treasury regulations. Readers tired of acrostics might take this as a week-end problem, asking themselves how they would act in like circumstances if they were brokers.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, March 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	10½d.	2½d. inc.
a " Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	"	£9	10/- inc.
a Bisulphide of Carbon	"	£21	..
a Borax	"	£20	20/- inc.
a Copper Sulphate	"	£28 10	£1 inc.
a Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	£75 to £80	..
a " Chlorate	per lb.	1/6	2d. inc.
a " Perchlorate	"	1/6	6d. inc.
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a " Chlorate	per lb.	9½d.	¾d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8¼d.	..
METALS, &c.			
Aluminium Ingots, in ton lots	per ton	£90	£5 inc.
" Wire, in ton lots (1 to 14 S.W.G.)	"	£120	£8 inc.
b " Sheet, in ton lots	"	£ 90	£8 inc.
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	..
c " Tube (brazed)	"	10¼d.	¼d. inc.
c " " (solid drawn)	"	10¼d.	¼d. inc.
c " Wire, basis	"	9¼d.	..
c Copper Tubes (brazed)	"	11¼d.	¼d. inc.
c " " (solid drawn)	"	11¼d.	¼d. inc.
g " Bars (best selected)	per ton	£86	..
g " Sheet	"	£86	..
g " Rod	"	£86	..
d " (Electrolytic) Bars	"	£71	£1 inc.
d " " Sheets	"	£89	£1 inc.
d " " Rods	"	£77	£1 inc.
d " " H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	1/8	..
b Gutta-percha, fine	"	6/10	..
b India-rubber, Para fine	"	2/5½	½d. inc.
f Iron Pig (Cleveland warrants)	per ton	61/-	4/2 inc.
f " Wire, galv. No. 8, P.O. qual.	"	£18	£1 inc.
g Lead, English Pig	"	£24	£3 5 inc.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£13 5	5/- dec.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/8½	..
p " " rolled strip & sheet	"	1/8½ to 1/6½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	"	£187 to £191	..
n " Wire, Nos. 1 to 16	per lb.	2/6	1d. inc.
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't's (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SEARCHLIGHT PROJECTORS.

By C. W. DENNY, A.M.I.E.E.

(*Concluded from page* 349.)

The use of flame or mineralised arcs necessitates a different form of mirror and different controlling mechanism. The flame arc projectors, and also the use of petrol-oxygen in projectors, the writer hopes to deal with at a future date. In consequence of the excessive heat generated by the electric arc, it has been necessary to give special attention to the ventilation of the projector body and mirror. When projector lamps are consuming current up to 200 amperes, it will be readily appreciated that some means must be provided to carry away this heat. It may be mentioned that a metallic mirror, after being a considerable time in use, reached a temperature in the neighbourhood of 700° F., with an arc taking approximately 180 amperes. The heating up of projector bodies and fittings, more especially in the case of small projectors, and even large projectors when used in a sheltered position, is a source of trouble in handling, and is always dangerous in the case of crystal glass mirrors.

A suggested method of cooling the barrel was recently brought before the writer's notice. It consisted of ribbing the barrel with light angle sheet $\frac{1}{8}$-in. thick, and also the back of the mirror frame. In the case of the latter special flat plates were allowed to press lightly against the mirror (metallic mirrors being used) as a means of rapidly conducting the heat to the ribbed cover, which materially lessened the temperature rise of mirror and barrel. Of course, the ribs on the barrel were omitted where doors, ventilators, and other mountings interfered with their use. It was claimed

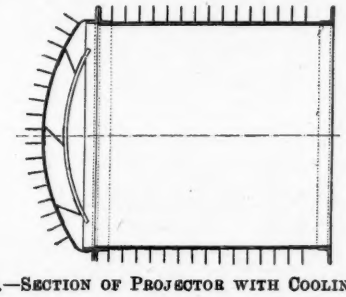


Fig. 3.—Section of Projector with Cooling Ribs.

that the radiating surface of the projector body was increased 75 per cent. by the ribs. A rough sketch of such a method is shown in fig. 3, the usual ventilating hole being omitted in the sketch. A further advantage is the use of wooden handles, or, to be more correct, iron handles with a wooden covering or sleeve, on mirror frames and front glass doors, as the usual iron handles become too hot to be comfortable after prolonged use.

Mechanical Movements of Projectors.—The balancing of the projector body on its trunnions is usually accomplished by having one of the trunnion guide rods screwed and passing it through a screwed hole in the trunnion bracket at each side of the barrel.

Any movement of the barrel parallel to its axis can be made by revolving the screwed trunnion rods. It is preferable that the screwed rods should be coupled together by chain gear or other approved means whereby both rods revolve at the same time, keeping the barrel quite parallel with the guide rods. This is of the first importance on military projectors, where adjustments of the barrel have to be made rapidly and often in action. The movements of the projector barrel through 30° above and below the horizontal and the describing of a complete circle by the turntable are accomplished by means of worm gearing, which is so arranged that it can be thrown out of action should it be desirable to move the projector rapidly by hand.

Various friction plates and clamping screws are in vogue for stiffening the movements of the barrel and base when operating the projector by hand. Difficulties sometimes occur with devices of this kind, inasmuch as the operator often throws out the worm gearing for obtaining the slow motion before sufficiently tightening up the clamping plates, the result being that the projector body, if not perfectly balanced, swings rapidly through the range of its lower movement, and in the case of a large projector comes with a heavy bump against the fixed stops which limit such

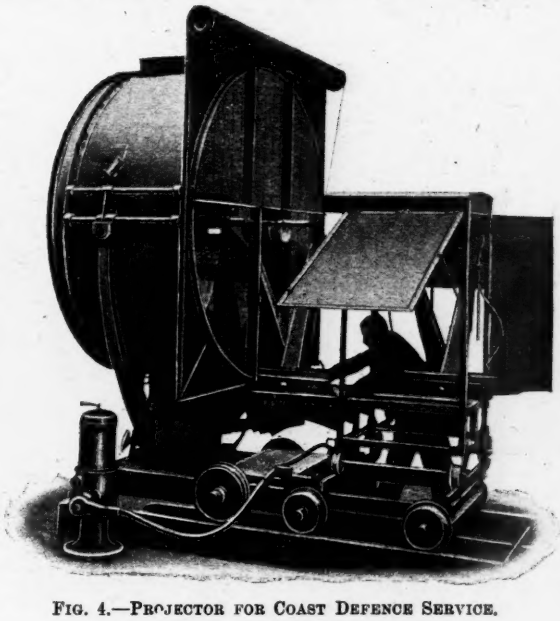


Fig. 4.—Projector for Coast Defence Service.

movement. Such rough usage is not conducive to the long life of the mirror (if of crystal glass) or other delicate parts of the optical apparatus.

Various suggestions have been put forward with regard to a "one-wheel control" arrangement for projectors, that is, operating the movements of the barrel and turntable at one and the same time by one wheel. By means of suitable clutches, either turntable or barrel can be operated

Fig. 5.—Field Service Projector.

separately, the advantages in support of this arrangement being the ease of manipulation with one hand-wheel, as against two, and that the operator always has one hand free to attend to the lamp, &c. Although there are these points in favour of such a device, the writer does not advocate its use, owing to the somewhat complicated clutch mechanisms employed.

Numerous improvements have recently been made in connection with switches and resistances; for projectors the latter should always be of the adjustable type and well

ventilated, combined switches and resistances arranged in the projector base being amongst the more recent improvements. Improvements in arc deflecting magnets, arc-centring gear, &c., are more or less of recent date.

Several very efficient types of portable generating sets are now on the market for use with field service projectors, or on ships where electrical equipment is not general. These usually consist of a gasoline engine and multipolar dynamo mounted on a light cast-iron bed-plate.

Some approximate particulars of a double-cylinder four-cycle engine and dynamo are :—Output, 30 to 35 amp. at 110 volts; weight, 650 lb.; length, 42 in.; width, 20 in.; height, 30 in.; R.P.M., 750.

Fig. 4 shows a projector arranged for coast defence. It is controlled electrically from a distance, in such a way that the operator is remote from the beam of light, and also in the best position for observation. Projectors of this class are preferably provided with lamp carriages, to enable the substitution of a new lamp for one whose carbons are consumed to be carried out with the minimum of delay, so as not to interrupt the light longer than neces ary.

A characteristic type of Continental field service projector is shown in fig. 5, mounted on its carriage. It is supplied with current from a generating set on another equally mobile carriage. The use of the metallic reflectors has permitted the construction of light and easily manipulated carriages for projectors up to 36 in. in diameter, which are extremely useful in hilly or mountainous countries.

THE EFFECT OF THE PRESENT COAL POSITION ON THE BUSINESS OF ELECTRICITY SUPPLY.

[COMMUNICATED.]

Within the last three years the public have had at least three demonstrations of the fact that the price of coal will be raised on the slightest pretext, and that within a few days of the first advance in prices coal merchants who have entered into quite large contracts to supply regularly week in and week out a stipulated amount of coal of a certain quality, will unblushingly declare that they are unable to obtain the stipulated amount, and that to their intense sorrow they needs must curtail supplies.

This state of things lasts for a short time, when the harassed station engineer almost implores the coal merchant to procure for him coal of any burnable quality at what he is pleased to term, vaguely, anything like a reasonable price, as his stock is showing signs of depletion.

Within a day or two the kindly merchant informs the station man that although he (the merchant) cannot supply the demand himself, yet after considerable trouble he has persuaded the firm of So-and-so to let him have about a two or three weeks' supply at a figure about 60 per cent. or 70 per cent. higher than the engineer has been paying.

Naturally the engineer resents being bitten, but as his place was not originally laid out for coal storage on a large scale, he soon has to come down and accept the coal merchant's prices, which in the few days of haggling have again advanced.

Now this sort of thing is going on all over the country at the present time; therefore, it is hitting each and every district in a most vital part, viz., its electricity supply, at a time when it is of the utmost importance that things should go rapidly and smoothly along their proper path.

There may be in one or two places a genuine shortage of coal or wagons to convey that coal, but to nothing like the extent which the coal merchants pretend. This is proved by the fact that after the engineer has agreed to pay the extortionate prices asked for fuel, he continues to get just sufficient to keep him going at the enhanced prices. Make no mistake, the writer speaks from bitter and costly experience; your coal merchant knows to a nicety what is your storage capacity, and adjusts his tales of scarcity, high prices and impossibility of delivery to suit the exact conditions under which he knows the plant has to work as regards coal.

It is true that he has entered into a business contract to supply so much coal at a certain price, but it is also equally true that he will not supply that amount of coal at that price as long as he can obtain higher prices from other people. In short, he will declare that he cannot get your coal, and therefore must be relieved from his contract. He will also, within an hour of telling this tale, sell the coal he has solemnly agreed to deliver to you, to someone else at a much higher price.

Now, such callous and disgraceful breaking of contracts should not be permitted. The prosecution of such offenders in one or two industrial centres should be taken up by a combination of coal consumers formed for the purpose. This may, perhaps, be a difficult matter, hampered as the supply stations are by being under municipal control in many instances.

In one way, the antics of the coal merchant, resulting in the uncertainty of coal delivery as soon as a slight strike, or rumour of a strike, crops up, should send more power users on to the mains of electricity supply works, and it should be possible in such cases to pick up a good many small and medium power loads at prices between ¾d. and 1¼d. per unit.

This, however, will only shift the burden from the shoulders of the works owner or manager on to those of the supply station engineer. What is necessary is some means of controlling the supply of coal without the intervention of the middle-man, who has shown time and again that he can only be trusted to break his agreements whenever it pays him to do so. This, of course, implies the control of one or more collieries, which at once introduces difficulty.

The municipal ownership of the majority of supply stations stands in the way of concerted and powerful action, as the Local Government Board would not sanction any share in such a venture; again, the case has to be considered from several aspects. Not all the coal raised would be steam-raising coal of the type required, and to market the remainder would necessi ate a capable selling organisation, as the ordinary coal merchant would not purchase or sell coal from these collieries on any consideration.

Added to the above difficulty is the one of delivery. Stations on the railway with a siding could make arrangements to supply so many wagons to the railway company, and enter into an agreement with them that these wagons were to be dispatched regularly at certain convenient times as long as it was possible to work the railway. This contract should be in its essence as binding as a Government contract, and it would be worth the while of any power station which had been harassed and bled to pay a little extra to the railway company for the privilege of obtaining such a contract.

Consumers not on the railway would have to provide their own wagons, and might do much good by using electrically-driven coal wagons for this purpose. The batteries could be charged up overnight, and the continued use of the wagons would result in other persons in the town watching the result and obtaining such wagons themselves, and so offering a load desirable in every way to the power station. The original difficulty, however, of obtaining control of the colliery is the greatest difficulty, and to the writer it does not seem possible to surmount this at present.

Many of the largest industrial firms possess their own collieries, and antics such as those at present indulged in by the coal merchants were the cause originally of these concerns entering into the colliery business.

The matter, however, is important for every supply station, whether it has or has not sufficient storage capacity to render itself immune from this evil for some months.

Storage of coal means extra handling, once into and once out of storage at the least; it occupies valuable space, and means that unless the coal is regularly removed from storage and burnt the calorific value will be greatly depreciated, and in turn this demands a regular putting into and taking out of storage of a considerable quantity of coal. There is also the risk of spontaneous combustion to be considered, and the fact faced that its prevention costs money, in that space must be allowed for thorough breaking-up of the coal into fairly small bulk.

The solution of putting the power stations at the pit mouth is very easy to propose, but two important considerations are overlooked. One is that such policy means the scrapping of a good deal of modern and exceedingly valuable plant of large size, and the other is that it means fairly long transmission of the power so generated. The latter problem is not at present a commercial success in these islands, judging from the results attained by the various power companies who have been in the business for several years. Perhaps the easiest and most direct way out of the position would be for the leading men in the power supply industry to meet and take steps either to force one of our existing organisations to move the Government in the matter, or, failing that, to form an association to influence Members of Parliament to take up the passage of a measure putting the supply of coal to power stations on the same basis as the supply of war material; that is, the supply must be maintained at the prices agreed upon and in the quantities promised, even if to do so required the enlistment of colliers in a special manner and at special rates of pay, with the stipulation that refusal to work would be treated as mutiny in the Army or Navy would be treated.

The work of the power stations is vital to the well-being of the nation. The coal merchant has repeatedly shown his indifference to all considerations other than those of profit, and should be treated as an unpatriotic and untrustworthy person.

RUSSIAN TRADE AND ELECTRICAL PROSPECTS.

(Communicated.)

Vital as the present war is to all the Allies, Russia is undoubtedly the country which will profit most by the conflict, for it will complete the work begun by the institution of the Duma and the guarantees for constitutional government; and will make good the loss of prestige and credit sustained by Russia in the Russo-Japanese war. It is effecting consolidation of the people, confirming the stability of the constitutional *régime*, and bringing Russia into close and amicable relations with her Allies. In short, the "awakening" of Russia is being completed by this war, and once peace is declared, rapid industrial development will occur. Hitherto the country has been chiefly agricultural, but the natural wealth is beyond estimation, and there is room for the development of practically every industry. The dredging of rivers and building of railways and factories which have already begun will proceed faster than ever, and with them will now arise an enormous demand for machinery and manufactured products of every kind. Internal resources will be inadequate for some time to come, to keep pace with this rapid development.

There is an immense potential power field in Russia, both in production and utilisation, and in the present state of engineering it goes without saying that a very large percentage of this power will be supplied electrically. The business boom of two or three years back was accompanied by great extension in the use of electricity in Russia. It is now used extensively in textile mills, in oil fields, in electrochemistry and in blast furnaces. Further, the advantages and possibilities of electrical development are fully appreciated by the Russian Government and many municipalities, so that in this vast country, which has recently advanced centuries in decades, and is now prepared to take up to the full extent 20th century industrial existence, without being burdened by any of the impedimenta of gradual evolution, there is an unparallelled field for electrical development. Though some of the equipment required for new and extended central stations, hydro-electric plant and transmission, tramways, railways, telegraphs, factories, streets and homes will be supplied by existing and new Russian firms, there will necessarily be enormous imports of manufactured electrical material of all kinds for years to come, and British firms can accelerate or retard Russian development, gain trade for themselves, lose it to rivals, or compel premature manufacture on the spot, according to the nature and degree of their activity.

Hitherto Germany has enjoyed the major portion of all Russia's foreign trade, actually controlling a large fraction of the exports as well as supplying the greater part of her imports, but the advantages Germany has had in respect of geographical position and excellent commercial organisation will be entirely outweighed in future by her shattered credit, crippled resources, and possibly disintegrated national structure, not to mention the formidable barrier of sentiment which she has thrown up against herself by her ill deeds and which will take years to demolish.

On the other hand there was already, before the war, a strong movement in Russia in favour of English goods (which the amiable German did his best to gratify by selling German-made goods with forged English trade marks). Many English firms had realised and begun to take advantage of the possibilities of Russian trade, and now there should be no hesitation in so doing, for English firms have been more than semi-officially invited to enter the Russian field, and all Russian sentiment will henceforth be more strongly than ever in our favour. We have, however, in the German, a trader thoroughly versed in every phase of organisation and enterprise —honourable and dishonourable. His ability will not be affected by the war and, though his opportunities will be much less favourable, we must remember that the degree of his necessity will be the measure of his efforts, and we have tremendous leeway to make up both in methods and results.

The total value of Russian imports of all kinds was three times as great from Germany as from England in 1910, and by 1914 the ratio was 4 : 1, the respective values being nearly £40,000,000 from Germany and a bare £10,000,000 from England. Our electrical exports to Russia compare even less favourably with those from Germany. In 1912 Germany exported to Russia £230,000 worth of dynamos, motors and transformers, *i.e.*, twice the value of her corresponding exports to England, and about the same value as her corresponding exports (each) to Italy and Argentine. Of this total, machines and transformers up to 220 lb. weight were worth £52,000; from 220 to 1,100 lb. £66,000; and over 1,100 lb. £112,000. The total exports of electrical machinery of all kinds from England to Russia were valued at only £59,900 in 1913. German exports of glow lamps to Russia were valued at £466,000 in 1912, *i.e.*, 50 per cent. more than the value of lamps exported to England, and 25 per cent. of the total exports of this class from Germany. We sent £200 worth of metal filament lamps to Russia in 1913. It is interesting to note that we send about £250,000 worth of belting to Russia (about 15 per cent. more than Germany does), and our wide connection in this class of goods should prove helpful in introducing British electrical equipment to Russian power-users—assuming a certain amount of co-operation among British firms. Immediately before the war Russian electrical imports must have been worth close on £2,000,000 per annum—possibly more —and soon after the war their value is likely to become greater still. There is an immense market positively waiting to be taken—much of it we can take if we get busy now and go the right way about it. But Germany's defeat in the field does not mean that she will give up the Russian (or any other) market without a severe struggle.

Many of the ramifications of German influence and control in the Russian electrical industry have only been realised since the outbreak of war severed some of the hidden arteries which used to feed apparently

independent concerns. The great German electrical firms operating in Russia were under direct German control, and had a very complete series of working agreements and "understandings," which permitted them all to do good business yet never allowed any dissension or competition giving outside firms a reasonable chance of success—simply another example of the vast possibilities of co-operation with "competitors." Just as since the war large quantities of electrical goods have arrived in Russia from "neutral" countries, branded artlessly with neutral trade marks which do not suffice to disguise the Germanic origin of the whole; just as since the war German "commercials" travelling with neutral passports (purchased or worse) have sold these neutral goods; so in the years preceding the war many independent firms, "Russian," "Belgian," and others, were German at the core. The institution of really independent concerns was at once crushed by ruthless use of the whole capital and influence of the German combinations and the banks and diplomats supporting them.

Besides availing itself to the full of every legitimate method, German commercialism, like German militarism, has been characterised by highly organised treachery and deceit—underhand machinations being often employed when honest endeavour might have attained the same end with the single objection (in German eyes) that the extent of German dominance would have been prematurely disclosed. It is an established fact that representatives of German firms have given gratuitous and "disinterested" assistance to those responsible for municipal and other electrical schemes in Russia, to such purpose that the ultimate scheme and specification have appeared in such form that German products alone could fill the bill. This and other even more dubious methods do not appeal to the British mind, but with contract after contract, aggregating hundreds of thousands of pounds per annum secured by such means, we must at least add fresh weapons to our commercial armoury.

While it is unnecessary to credit Germany with any particular commercial morality, it would be equally foolish to underrate her commercial ability, and some of her methods should undoubtedly be employed by us. There is no reason, for instance, why our banks should not be as powerful agents in industrial development and association of interest here as in Germany. The commercial activity of German embassies, and the application of "diplomatic pressure" to secure trade for Germany, find no counterpart in our State. Our consular service and the Board of Trade are all right so far as they go—so far as they can go—but fully qualified commercial and technical attachés reporting to a Department of Commerce can alone render the service desirable.

Remote control is quite inadequate in seeking to trade with Russian markets. Without frequent visits by an experienced representative or, better, permanent travelling representatives, it is impossible to gain the necessary intimate knowledge of conditions and developments. For years past Belgian and German firms have been represented in Russia by commercial engineers speaking French, German and Russian, and dealing directly with small as well as large clients. To the energy and intimate knowledge of Russian and Polish trade conditions possessed by their representatives. German firms owe most of their success in this field. The favourable geographical position of Germany is a factor of much less importance than is generally supposed.

There are some British-owned factories in Russia and a number of agents (actual or potential) well versed in the language and trade conditions, and if a British firm do not wish at present to send out a man of their own, they may still be represented effectively on the spot. Indeed, it is advisable in any case to examine closely what co-operation is possible with firms and agents already well-established in the country.

The language difficulty has prevented many British firms from venturing in Russian markets, but the latter are so valuable that the difficulty must be faced and overcome. Circulars and correspondence in English will result in very little business, any thus obtainable being generally already fixed in destination. French and German are chiefly used by Russians for scientific and other publications, for which a wide circle of foreign readers is desired, but Russian is the only language which will permit exporters to get into really close relations with clients and take full advantage of the enormous business to be done with smaller concerns, any one of which, under existing circumstances, is likely to develop much and rapidly in importance, and will naturally continue most of its earlier connections. In the past only too many British firms have employed German "foreign correspondents" in their offices. Surely it is now sufficiently clear why a docile, hard worker and skilled linguist could be obtained at the wage of a junior clerk. It is not flight of imagination or prejudice, but a sober fact, that a high percentage of German clerks in this country used to send home each week business reports which in the aggregate cost their employers far more than they saved in wages.

There is a good demand in Russia for standard electrical equipment of English design and manufacture but, particularly among the smaller traders where price is everything, it is essential to be able to offer apparatus at least as good as the corresponding German lines and at competitive prices.

In the phrase "German goods are adapted to local requirements" (*vide* consular reports without number), lies the reason for order after order going to those who are not our friends. If we are learning better than our take-it-or-leave-it attitude, our improvement is terribly slow. It is totally inexplicable why so many British manufacturers will see no further than the end of their noses, and quite fail to realise that what they lose on perhaps nine out of ten special orders, they recoup handsomely on a steady stream of orders following the tenth special job. The whole matter reduces simply to this, that there *are* firms who will go out of their way to satisfy special requirements, who do this at reasonable prices and yet make an annual profit. Those firms, whatever their nationality, are the ones to whom the future belongs.

It times of peace it was well worth executing special (as distinct from freak) orders, and in the critical years following the declaration of peace it will be yet more worth while, when the tremendous demand for war munitions collapses as suddenly as it arose and the world's trade is *redistributing* itself as it certainly will do. Have not manufacturing firms in this country repeatedly gone to Germany for special work in the past because they could not get the attention they desired at home, and will they never apply this lesson to their own morals?

There is undoubtedly a tendency on the part of the average British manufacturer to ignore or attach insufficient importance to the broader principles and customs of trading in foreign markets. In respecting these, the German excels, and by sheer method and attention to minutiae he succeeds, though it is an unprejudiced fact that he has never been popular abroad.

(*To be concluded.*)

Science and Industry.—The Institute of Industry and Science has, by permission of the Lord Mayor, called a "Conference of Leaders of Industry and Science" at the Mansion House, for Thursday, March 25th, at 3.30 p.m. There will be a discussion on "The Co-operation of Science and Industry."

ELECTRIC COOKING.

By W. B. COOPER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March 11th*, 1915.)

So far, in the cooking field, electricity has been chiefly in competition with gas, in smaller houses and flats; in larger houses coal ranges are more usual, because the cooking is more continuous and because hot water is required in large quantities. Naturally the revenue from an electric cooker replacing such a coal range is considerably greater and more profitable than that from a cooker in the smaller class of house, because the large cooking consumer, unlike the large lighting consumer, has an appreciably better load factor than the smaller consumer.

In the example to which the author wishes to refer, the number of persons normally in the household is from eight to nine, and there is a good deal of cooking, though not of an elaborate kind. A fairly large cooker, by Messrs. Purcell & Nobbs, was therefore selected, of which the following are brief particulars :—

	Maximum loading.
Oven { upper, 2,000 watts / lower, 1,000 „ }	total, 3,000 watts.
Grill	1,500 „
Two 8-in. hot plates...	each 1,500 „
One 6-in. hot plate	750 „

The electric heating of domestic water is not a proposition that is financially impracticable. It is a question of tariffs. Pending the taking-up of this matter seriously by central-station engineers, it was thought best to install a separately-fired coke boiler for supplying the hot water.

The average consumption was found to be about 2 KW.-hours per person per day in the winter-time and about 1·6 in the summer. The consumption per week was approximately 110 KW.-hours in the winter-time and, say, 90 KW.-hours in the summer.

Before electric cooking was adopted the average annual cost (based on the two preceding years) with coal was as follows :—

Electrical energy for light and other purposes	£9	0	0
Meters	1	0	0
Coal	13	10	0
	£23	10	0

With electric cooking the result for the year was as follows :—

Electrical energy for light, &c., as above ...	£2	16	3
Electrical energy for cooking (including fixed charge) 5,024 KW.-hours (average price, 1·04d. per KW.-hour)	21	19	0
Meters	1	0	0
Coke and coal	6	13	6
	£32	8	9

In the above no credit has been allowed for certain advantages of the electrical system. The number of KW.-hours for lighting and other uses has been taken to be the same in both cases, and a correction has been introduced for a short period of defective meter working. The net result is seen to be an increase in cost of £8 18s. 9d. per annum over the cost of cooking with coal. The initial outlay was as follows :—

Electric cooker	£23	15	6
Cooking utensils	2	5	0
Wiring for supply to cooker	9	4	5
Boiler and connecting up same	10	6	4
	£45	11	3

Later, a porringer taking 800 watts and having three heats was added, which, with wiring, cost £4. This was found to be a great convenience. The above are list prices.

There are many cookers on the market of lower price than the above. On the other hand, the cost of wiring is undoubtedly a heavy proportion of the whole, and must inevitably remain high so long as engineers adhere to the fashion of using screwed tubing. Wood casing might be employed equally well. The author sees no reason why armoured cable should not be used without further protection.

A main double-pole switch should be fixed in a handy position near the cooker, and a pilot light should be fixed so that the cook cannot help seeing whether the power is on or off.

It is most important to have the branch switches in a position where they are not only easily seen, so that the various heats are ascertainable at a glance, but also easily operated. For this reason it is very undesirable to mount them on the side of the cooker; switches are best placed on the wall behind the cooker, somewhat to one side. The author prefers a small fuse on each circuit to one large one for the whole cooker.

A thermometer should be provided. The usual rough-and-ready method of judging the temperature of an oven is to open the door and thrust in the hand. The oven here considered requires 10 minutes for the temperature, as shown by the thermometer, to rise from cold to 350° F.

It has been freely stated that the loss in weight with coal or gas cooking is, say, 30 per cent., whereas it is, say, 15 per cent. with electric cooking. Actually, it is impossible to give a fixed figure. If there is much fat the loss will be heavy, whereas, if the joint is lean, the loss will be much less.

Figures which the author obtained in the course of ordinary working, and which show the loss of weight, may be of interest :—

Loss When Cooking by Coal.

Character of joint.	Original weight.	Loss.	Remarks.
	lb. oz.		
1. Rolled ribs of beef	4 7	29½ %	—
2. „ „	4 2	29 %	—
3. „ „	3 13	18½ %	Rather lean.
4. „ „	4 9	23 %	—
Average ...	...	25 %	

Loss when Cooking by Electricity.

Character of joint.	Original weight.	Loss.	Remarks.
	lb. oz.		
1. Rolled ribs of beef	3 14	13 %	—
2. „ „	3 8	14½ %	—
3. „ „	3 13	13 %	Joint lean and rather underdone
4. „ „	4 1	20 %	Joint rather fat
5. „ „	4 1	12½ %	—
6. „ „	4 12	14½ %	Joint rather fat
7. „ „	4 6	14½ %	—
Average ...	...	14½ %	

Extravagant claims in this, as in any other direction, are to be deprecated. It is forgotten that the roasting of joints is but a small part of the total cooking.

The author found that a suitable routine, in the case of joints, is first to raise the temperature to 350° F.; the joint is then put in, the temperature is allowed to fall to 250° F. by switching off, and is kept (by switching on the low heat occasionally) between 250° F. and 300° F.

The energy required to heat an oven is not as great as might be expected. In the present case the oven, with an input of 3 KW., reaches a temperature of 250° F. in 5 minutes, *i.e.*, by the expenditure of 0·25 KW.-hour. For small operations, such as keeping dishes hot, the author has found it convenient to use a hood of tin-plate, preferably double, as shown in fig. 1, which can be placed over any hot-plate as a heating element. It is provided with a low metal stand and deflecting plate so that the heat is not excessive near the hot-plate; or an asbestos sheet may be used to give protection.

It is desirable that an oven should heat up so rapidly that the heat losses have not much time to take effect, after which the input can be reduced simply to supply these losses. For these reasons the time taken to reach a temperature of 300° F. should not exceed 10 minutes.

Accessory apparatus is often desired, and then a plug circuit is inevitable; plugs are sometimes provided with shields, which give some protection. The author thinks, however, that it would be more satisfactory to fit a metal ring round the socket (as in fig. 2) so that the pins are not exposed so long as they are alive. This ring should preferably be earthed. The live metal of the socket for the reception of the pins of the plug is often brought nearer to the surface than is necessary, and can be touched by persons when cleaning.

In portable utensils the pins are often exposed when the socket is in position, if it is not pushed home. These pins should be housed, as indicated in fig. 3.

One of the troubles with flexible wire is the annoying way in which ordinary qualities break on account of being continually subjected to bending. The layman cannot put the matter right without calling in assistance—which means delay and a bad advertisement for electrical methods. Many of the usual twisted

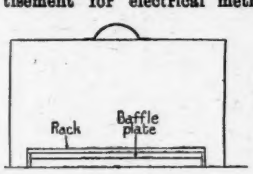


Fig. 1.

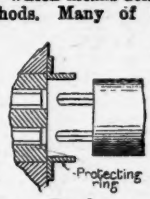


Fig. 2.

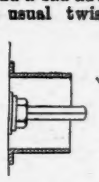


Fig. 3.

Fig. 1.—"Portable" Oven.
Fig. 2.—Protection of Sockets.
Fig. 3.—Protection of Pins by Housing.

flexible cords are unsuitable for this class of work, and special types should be used. These are now becoming available.

The author has recently subjected a number of samples to a bending test. It is apparent from these tests that ordinary flexible wires vary very much in their mechanical properties, and that it is not necessary to depart from the ordinary type to get excellent results.

It is generally recognised that electric cookers should be earthed so as to ensure immunity from shock. There is no question that the earthing should be to a water pipe, and that the effectiveness

of the earthing should be tested. Earthing clips and wires should be more substantial than is generally the case. It would be an advantage if such clips carried a red metal label bearing the words "Earth Connection—Must not be Removed."

The mixing of earthed and unearthed apparatus is much more dangerous than to discard earthing altogether. The plain form of wall-plug should not be permitted in the kitchen: there the three-pin variety with earthed connection should be used, and leads should be in flexible metal tubing, the utensil, tubing, and plug being properly connected together. Similarly, tumbler switches with metal covers should not be permitted on cooking apparatus except with an earthed connection.

The Council of the Institution should draw up rules as to earthing. At the same time the standardisation of socket connections on electric irons and similar apparatus might be considered. Manufacturers should realise that there is nothing to be gained by every manufacturer having his own size and spacing of pins. To the user it is exasperating to have to buy a particular socket connection for a particular piece of apparatus.

Occasionally the consumer is fortunate enough to have the offer of a very low flat rate. More generally, however, the tariff involves a primary charge which may depend on the rateable value of the house or upon the amount of lighting and plant installed, and, further, a secondary charge of so much per KW.-hour consumed. As a possible consumer the author objects to paying a heavy primary charge when he may be using only a cooker. In comparing the cost of electric cooking with coal cooking, this heavy charge may be sufficient to deter him from making the experiment with a system of which, as a householder, he has no first-hand experience. That is the attitude that must be borne in mind.

That the primary charge provides for the fixed charges of generation for the lighting load is a fair basis on which to go. In that case it should bear some relation to the maximum lighting load. During the last few years many station engineers have complained that the lighting load was much reduced through the use of metal-filament lamps; yet there seems to be no tendency for the percentage charged on the rateable value to be reduced.

If the assessment basis is found to be generally expedient, then the author would suggest that the rateable value should be treated as an elastic quantity, subject to the discretion of the engineer. It is obviously absurd that a consumer should be made to pay a larger primary charge than is necessary simply because he has a garden. The engineer should remember that a high assessment probably carries a higher load factor with it, and he should, therefore, try to meet the consumer, as far as possible, on the primary charge.

The second point that has impressed the author is the great importance of a low secondary charge, such as 0·5d. This is important, because cooks are often wasteful, and the householder soon finds that it is less serious to waste a halfpenny than a penny. Moreover, such waste is all to the good for the station; it means a higher load factor, and for that reason merits a lower price after a certain quantity of electrical energy per KW. has been consumed. In the case here discussed, some of the tariffs in use by certain members of the Point Five Association would have shown very little difference in the total cost between electricity and coal. This fact is surely an achievement.

In the case of the cooker, to which reference is here made, over a period of 13 months, the oven showed no defect, and the grill only gave one partial failure. The hot-plate is the most vulnerable part of an equipment. Maintenance is a subject of vital importance to the consumer. If, say, a hot-plate, or an oven, goes wrong, he does not like to be kept a week or more for the repair to be made. Moreover, he would like to know quite definitely how much the maintenance is going to cost him per annum. In a question which is of equal importance to the station engineer and to the manufacturer there should be co-operation between the two. The manufacturer should be prepared to quote a reasonable figure for maintenance. It may very possibly cost him more than this amount, but he is still seeking experience and should be prepared to pay for it. The station engineer on his part is anxious to keep the consumer satisfied. He should, therefore, be prepared to carry out the maintenance on behalf of the manufacturer at practically cost price; but the manufacturer should not expect more than this.

There are still some station engineers who think that the diversity factor of a cooking load is not high. On the other hand, it is sometimes stated that the diversity factor is as high as 20. This figure, however, is based on the maximum possible load of the apparatus, and it would seem more reasonable to take the consumer's maximum as being about 75 per cent. of the maximum possible. Thus the figure of 20 would drop to 15, which means that the load factor of the individual consumer is under 7 per cent.

In the case referred to at the beginning of this paper, the maximum possible load is about 8·5 KW. The average consumption per day (omitting a period of absence in summer) is about 14½ KW.-hours, giving a daily load factor of 7·1 per cent. If the working period of 15½ hours per day is taken, the load factor becomes a little over 10 per cent. Since the product of load factor and diversity factor cannot exceed 100, it follows that the diversity factor of this particular type of consumer could not be greater than 10, but it might reach that satisfactory figure. It may well be that the larger apparatus shows the smaller diversity factor: but the load factor being higher, the desirable form of load (*i.e.*, 100 per cent. load factor on the distributors) is obtained with a smaller number of consumers. Owing to a lack of appreciation of these principles, people sometimes talk of impossible load factors of over 100 per cent.

The above remarks are supported by records which the author has taken, one of which is reproduced in fig. 4. It is evident from these that the load is well distributed throughout the day, the consumption in any part of the day varies considerably, and the character of the load varies from day to day. Consequently the combined loads of, say, half-a-dozen consumers of this precise type would give a much better curve than any of the curves taken

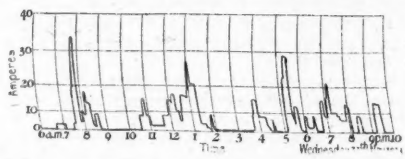


FIG. 4.—TYPICAL DAY COOKING-LOAD CURVE.

individually, because the "Tuesday" of one consumer may be the "Friday" of another. Fig. 5 is the composite or average curve which shows clearly the individual diversity of consumers having the same daily time-table. Actually the diversity would be greater owing to different houses having a different time-table. When, in addition, we remember the diversity of different classes

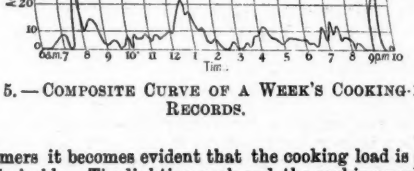


FIG. 5.—COMPOSITE CURVE OF A WEEK'S COOKING-LOAD RECORDS.

of consumers it becomes evident that the cooking load is one that is very desirable. The lighting peak and the cooking peak do not appear to coincide, and the average load from 6.30 p.m. to 8 p.m. is less than would be expected.

DISCUSSION IN LONDON.

MR. GEORGE WILKINSON (Harrogate), who opened the discussion, said the first thing that struck him was the title of the paper; he was unaware that members of the Institution were well acquainted with the subject. He thought that, generally speaking, the supply engineer had been too careful when he initiated new tariffs; commercial people were prepared to take some risk during the early years, but station engineers often fixed their prices on the basis of existing conditions instead of making an estimate of future output and basing the price on that. He had recently altered his own house and installed electrical apparatus throughout, and now used a 12-gallon electric water heater, thermostatically controlled, which gave a supply of hot water at 180° F., night and day, suitable for drinking or washing purposes. This was for a family of six and it required 12·8 units per day, giving a load factor of about 50 per cent. On the question of tariff, if a ½d. per unit was a fair price for a 25 per cent. load factor, surely ¼d. was fair for 50 per cent. If he had to start again, he would use a 25-gallon water heater with a small heater, controlled in the same way, thus increasing the load factor. He had found that the water from a coke boiler was unpleasant in taste, for drinking, but the water from the electric heater could be used in kettles, &c., and thus saved the use of hot plates. He had experimented with a "set pot" electrically heated, but found radiation losses too expensive. The ordinary wall plugs could be superseded by large switches in the kitchen, with advantage. He considered that the question of maintenance of cooking apparatus was a serious one, and did not think it could yet be recommended without qualification by the engineer; but the apparatus had been greatly improved. His experience was with four cookers, the last one for 18 months, and one hot plate had broken down three times in that period. It would pay the manufacturers to further improve this apparatus, so that it could be recommended as confidently as in the case of modern heaters.

MR. C. H. WORDINGHAM was inclined to think that the station engineer knew too much about electric cooking to adopt it in his own house, and considered that greater reliability was necessary before it could be generally adopted. He had always been surprised at the claims made as to saving in loss in weight of meat by electric cooking; this loss was due to the use of too high temperatures with any form of cooking. The difficulty of economically heating water electrically was a serious drawback, and he urged that they should give up that idea or it might hinder the progress of cooking: they must recognise the limitations. He, personally, did not see the use of 12 gallons of hot water; unlimited quantities were required, and he did not believe that any juggling with tariff would facilitate electric water heating. The author seemed to use the coke stove for keeping things hot and then called it electric cooking; he must pay heavily for his rapid heating, as the KW. went up and the load factor went down in such a case. He wished to draw their attention to the question of standardising cooking apparatus, which had formed the subject of a recent leader in the ELECTRICAL REVIEW. The sub-Committee of which he was a member had considered this matter. He felt that plugs must be standardised, but as for cooking apparatus, it was quite a different matter. The makers had been approached,

but there was a great diversity of opinion amongst them, and they were not eager. He could not help thinking that certain things could be standardised in regard to oven sizes and hot-plates, and it would be most helpful if the manufacturers who were present would give their views.

Mr. Allen (Wolverhampton) said there appeared to be very few remarks in the paper, which could come from a non-technical consumer. He did not see how the fact of using a large cooker led to a better load factor. In his experience an energy consumption of 1·6 units per head per day was the usual thing for a family of six. The author gave a fearful and awful bill for apparatus, but it was quite abnormal, and he was astonished that he had put it in. He agreed with his remarks on wood casing and earthing, but it was not his experince that people did not mind paying a lump sum for a cooker. The pilot light was being generally used, but the thermometer was a complication; they had cooked without it for 50 years, and could continue without it. As regarded the saving in weight of meat cooked electrically, he had always understood that it was the better temperature regulation which was possible, which led to this saving. The author's suggested earth-rimmed plug might be more dangerous than the ordinary one, and he had not referred to the flexible which had an embedded steel wire, and was now becoming common, nor to C.T.S cable, which was suitable. He agreed that the use of earthed and unearthed apparatus together was dangerous, and to be avoided. The rateable value system of charging was the best understood tariff, and the best one for introducing electric cooking, in his experience. It was, he thought, always an optional tariff, and the author could probably have had a flat rate if he wanted.

Mr. R. S. Downe said the point of view of most consumers in regard to electrical cooking was that it must be obtainable on reasonable terms. The various testimonials which he had received were more convincing than the paper. If the author had lived in the Brompton and Kensington area he could have paid 5s. or 7s. 6d. per quarter rental for his installation, fixed and wired, and would have had utensils supplied free, or if he desired to purchase, he would have had to pay £14 for the installation, including wiring, instead of the high sum of £35. Electric cooking would have to be carried out on exactly similar lines to the gas-cooking business all over the country, and in the immediate future an installation would not exceed £10 in cost. He agreed with Mr. Wordingham that electric water heating was too costly, and at his company's restaurant coke-fired boilers were now used, giving twice the amount of water for 7s. a week as against the electrical cost of £1. He considered that the gas people had prepared the way for electric cooking, and it would be adopted on an extensive scale in the near future. In his area they had about 100 cooking installations installed (during the past three years), and the progress was becoming rapid owing to personal recommendation. There was no doubt about there being in practice a considerable saving in shrinkage of meat by electrical cooking. As the result of inquiry he was informed that with the coke-fired ovens at Cadby Hall (Messrs. J. Lyons & Son's headquarters), there was a loss in weight of meat cooked over the year of 30 per cent. A test on a large scale of electric cooking showed only 18 per cent. loss, representing a saving of some 10s. worth of meat in that case as compared with the ordinary process. The average consumption of energy per cooker in his area was some 2,500 units a year; or 1½ units a head per day for five persons. It was estimated that at least 1,200 consumers in the area could adopt electric cooking, and taking an installation at 5 KW, the extra 6,000 KW. of load would only come on to the peak to the extent of 1,000 KW.

Mr. Grogan thought it possible that the author had been too much in the kitchen judging by the excessive energy consumption; he did not agree that the large consumer was better than the smaller one, as regards the cooking load, as the latter had the better diversity factor and load factor. He was glad the author had not adopted electrical water heating, as the result would have been awful; but the electrical method was satisfactory as regarded convenience and if a small quantity of water was sufficient. From his experience, a family of five should require from 1,500 to 2,500 units per annum for cooking and allowing the author another 1,000 units, or 3,500 units, this should be sufficient for seven people, so that his energy consumption was much too high. He knew of a Manchester household of similar size which took 65 units per week for cooking, as against the author's 110 units. He asked, was this paper going to help electric cooking? He himself looked upon it as a murderous submarine attack on the splendid progress made in recent years. The author had paid extravagantly for his installation; why should he inflate the bill by the cost of the coke boiler? He had apparently mentioned hiring of apparatus as an afterthought; there were some 30 or 40 towns hiring out electric cookers, and that was the only way to do the business.

Mr. Duncan Watson said the paper gave them the opportunity to correct the views put forward. His sympathy was with the engineer who was unable to offer a suitable tariff for cooking. He had heard that much more efficient apparatus was to be introduced shortly; at present maintenance was rather a serious matter.

Mr. Haydn Harrison had not found the paper to have much reference to the "consumer," as usually understood. As a user of electric cooking, he had turned up his bills for gas, coal and electricity for the past five years, during which period he had adopted electric instead of gas cooking, and it was not at all easy to tell when he changed over. His district was supplied by a company which did not encourage electric cooking, and charged 1½d. per unit for the supply and 5d. per unit for lighting, but despite this high price and the fact that gas was only 1s. 9d. per 1,000 cb. ft. the change over had not made any appreciable addition to the cost. He was afraid the paper would not be rightly read, and that it would be taken to mean that the author had made a loss of £9 after spending £45 on apparatus.

Mr. W. M. Mordey suggested that if the principle of the thermos flask could be adapted in the electric oven, a considerable saving in energy would result once the right temperature had been obtain.

Mr. Pinkney said the author's energy consumption for cooking was very high; in his own family 1·3 units per head per day were required over the first period of six months, and he was convinced this would drop to 1 unit or less, yet the author took 2 units with a "careful" cook. He was afraid the thermometer would not be used, although it would be advantageous if it were.

Prof. Morris said it was important that electric cookers should be hired, as apparatus suitable in one area might be unsuitable in an adjoining one, if the householder moved. He agreed that electric water heating was best left alone for the present, and that attention should be concentrated on cooking. He had found the cost of a coke boiler to be 3d. a day for a family of five or six and this could not be touched electrically. The same family required 1¾ units per head per day for cooking. A big scale thermometer would be a useful accessory if it could be mounted with the switches on the wall. He found that cooks did not understand what shocks were.

Mr. A. H. Seabrook felt that it was a case of "saving us from our friends"; he strongly deprecated the publication of such doubtful results. The large cooking consumer was infinitely worse than the small one in the matter of load factor, and in the matter of cooking load he would prefer, say, Ilford to Marylebone. In Marylebone there were one or two consumers using electric water heating; they were satisfied with the cost and that was all that mattered. The initial cost of the author's installation was utterly ridiculous; he (the speaker) could not find a householder who would buy a cooker—the hiring practice was too firmly established. There was no more sense in running a cooker on a single fuse, than there would be in running, say, a small town in the same way. He found that thermometers were soon taken off cookers, and that the Scott Ram hand-shield plug was quite satisfactory. He thought that the earthing of cooking apparatus was compulsory. The author's curves showed a non-peak load, with the largest demand in the morning. He mentioned that Messrs. Selfridge had now placed an order for an installation for staff cooking, which would be the largest in the world.

Mr. Nichols Moore said the author's paper should indicate to engineers what they had to deal with. He considered it futile to make random statements as to the saving in weight of meat by electric cooking; the author's figures showed a saving, but they were not cooking joints all the week, and the saving in £ s. d. did not amount to a great deal. He found in his own case that a "domestic" tariff with a secondary rate of ½d. per unit showed a slight saving in cost over flat-rate charges.

Mr. Gillott said he understood that the American navy had scrapped all cookers with top and bottom heaters, owing to the fat firing with the bottom heat. In his own case, with seven in the family, it required 97 unit per head per day for electric cooking. Why had the author debited all the fixed charges to electric cooking? This seemed unfair.

Mr. F. C. Raphael said the author had made the mistake of generalising from a particular case, and he was afraid much too great publicity would be given to his unfortunate experiments. The author's experiments on flexible had been forestalled by work already done in this direction.

Mr. Cooper replied very briefly, owing to the lateness of the hour; he felt justified in his paper in view of the contradictory nature of the discussion. He had regarded it as an optimistic paper! He agreed that electric water heating was very convenient.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

(*Continued from page* 378.)

A winder driven by a direct-coupled induction motor is erected at the Abercwmboi Colliery. The duty for which it was designed when fitted with a tail rope of equal weight to the winding rope is as follows:—

Depth of shaft	...	240 yards.
Output of coal per hour	...	180 tons.
Net load of coal per wind	...	50 cwt.
Number of trams per wind	...	2
Time of wind	...	35 sec.
Time of each complete cycle		45 sec.

The 3-phase motor is wound for 3,000 volts working pressure and has its rotor mounted on a continuation of the drum shaft. The continuous rating of the motor is 375 B.H.P., the maximum horse-power developed during the acceleration period being 700, with a power factor of 0.75.

A liquid controller is provided for starting and regulating the motor and is interlocked electrically with the oil-break main and change-over switches for reversing the motor. The resistance in the rotor circuit is determined by the height of the liquid, which is varied by a sluice valve connected to the controller. The liquid is cooled by pipes in which water is circulated, and is pumped from a storage tank in the base of the controller by a small electrically-driven centrifugal pump.

The winder is controlled by one lever which is connected to the main stator switch, the controller, and the brake engine.

The controller can maintain a minimum motor speed of 2.5 r.p.m. with one-tenth normal torque for 15 minutes for rope examination, etc.

The drum brakes are of the post type, and are weight-loaded air-operated with the Whitmore patent self-adjusting and variable-load appliances, by which the driver can apply any desired load upon the brake according to the amount that the foot lever is pressed down.

The air supply for the brake cylinder is provided by an electrically-driven compressor set. This set consists of a compressor direct-coupled to a 3-phase motor with automatic starting and stopping, controlled by the pressure in the receiver, the working value of which is 60 lb. per square inch.

Should the power supply fail either through failure of the main supply or the operation of the overload main-switch relays, the brakes are automatically applied and the winder drum is brought to rest.

A dial depth-indicator is used, with which is incorporated the overwinding gear. The latter in case of an overwind applies the brakes and cuts off current from the winding motor.

This winder has been in satisfactory operation for the last six years. The "peak" due to the sudden application of a load of 750 K.V.A. every 45 or 50 seconds is satisfactorily dealt with at the power station by the Tirrill regulator. The number of units per ton of coal wound without a balance rope, is 1.6 when winding 25 cwt. of coal.

Pumping.—The steam plant has been supplemented or displaced by single-lift centrifugal pumps, and in place of pump-

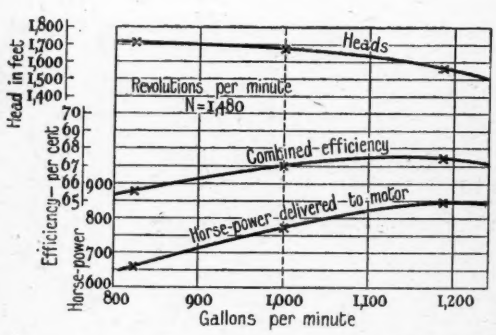


FIG. 6.—CURVES OF TEST RESULTS, 800 B.H.P. CENTRIFUGAL PUMPS, BARGOED.

PUMP DATA.

Head	1,660 ft.
Capacity	60,000 gallons per hour.
Speed and Type ...	Sulzer 8-stage, 1,480 r.p.m.

size of the pumping plant, two 17½-in. fans, one being in reserve, are erected in the passage way leading to the up-cast shaft and discharging into it; incoming air is brought through a special heading driven into the down-cast shaft. An air filter consisting of cloth stretched on wooden frames is erected at the incoming end of the pump room, and suitable dampers are provided at each motor for controlling the supply of air.

The system of forced lubrication employed for the pumps and motors consists of oil tanks fitted with submerged "spur-wheel" pumps, chain-driven by small 3-phase motors mounted on the covers of the tanks and supplying oil to the various bearings. Each pump is fitted with an oil filter which can be withdrawn and cleaned while the pump is in action.

The overall efficiency of the above set tested at full duty was 71.9 per cent.

Ventilation.—Up to a few years ago the general colliery practice was to use low-speed fans; latterly a considerable number of centrifugal high-speed fans have been employed.

All the principal fans of the Powell Duffryn Co. have duplicate motors as a stand-by to allow for cleaning and repairs. These fans are driven by induction motors, and in order to give flexibility in the volume of air the fans are rope-driven, to allow the pulley ratio to be varied.

At the new Britannia Colliery, the fan employed is designed for the full air output for ventilating the workings when the latter are fully opened out, but until this time has arrived it will run at speeds to suit the development. The electrical equipment consists of a rotary converter and continuous-current motor, the latter being direct coupled to the fan shaft. Speed variation is obtained by hand regulation of the field rheostat. The stand-by motor in this case is of the induction type, the fan being rope-driven.

Compressors.—Although the efficiency in transmission and conversion is low, compared with electricity, compressed air is largely used underground where danger may arise from dust, gas, or falls, for all small power drives. The Powell Duffryn Co. erect the main compressor plant in the winder house so that it can supply all requirements, the separate air systems

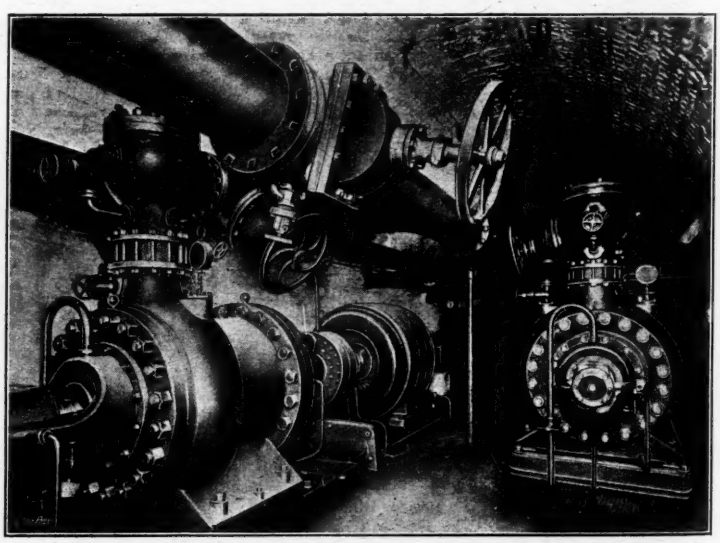


FIG. 7.—PUMPING STATION, ELLIOT PIT, SHOWING WESTINGHOUSE-SULZER PUMPS.

ing continuously, the main pumping is now confined at the Elliot Pit to 8-12 hours out of the 24 by enlarging the lodge rooms, the pumping in the other valleys being confined where possible to the night shift. This has a marked effect on the load factor of the power houses, and in the Rhymney Valley it has provided the continuous load necessary for the economical use of gas-engine plant.

The largest pumping station is at Elliot Pit, the pump room being situated at the foot of the up-cast shaft and containing three Westinghouse-Sulzer centrifugal pumping sets; two of these are driven by 950 B.H.P. 3-phase motors, and the third by a 1,000 B.H.P. motor, the following being the respective duties:—

	950 B.H.P.	1,000 B.H.P.
Gallons per hour	81,000	87,000
Head in ft. (manometric)	1,690	1,690
Full-load r.p.m.	1,475	1,475

The 1,000-B.H.P. pump is of Messrs. Sulzer's 6-stage type with special cast-iron casing and bronze impeller and guide wheels, and the makers' patent balance-disk method of taking up end thrust. The motor is of the slip-ring rotor type with liquid starter, the stator being built in a turbo-alternator frame. The windings are designed to give a temperature rise not exceeding 35 degrees C. above the inlet temperature of the air which passes through the pump room at the rate of 10,000 cubic feet per minute.

Owing to the confined nature of the pump room and the being interconnected so as to reduce the percentage of reserve plant.

As the air requirements are intermittent it is desirable to run the electrically-driven compressor at a variable speed. Large variable-speed compressors are at present only operated by continuous-current motors.

The compressing plant at Britannia Pit consists of three electrically-driven compressors, two running at constant speed driven by induction motors:—

Cubic feet of free air per min.	2,500	3,500
Motor r.p.m.	243	240
Brake horse-power	410	550

A further compressor plant capable of dealing with 5,000 cubic feet of free air is being added, driven by a continuous-current motor. The latter will be supplied from a 1,100 KW. 6-phase rotary converter which runs at 500 r.p.m. The speed of the motor is automatically varied by controlling the rheostat according to the air pressure in the delivery pipe.

At Abercwmboi the compressor is of the Belliss enclosed forced-lubrication type, driven by a 3-phase induction motor. The stand-by compressor is driven by a 140-B.H.P. induction motor.

Haulages.—Owing to the intermittent nature of haulage loads, the necessity for high torque at starting, and the tendency of all haulages to be used together towards the end of the shift, this load is one of the most costly to supply unless a large number of haulages are worked from the same power house. With induction-motor drive the speed is nearly con-

stant, consequently the power demand is proportionately increased on gradients, thus decreasing the already poor load factor with this class of load. Owing to the position of haulages it is undesirable to employ continuous-current motors, which involve with an alternating-current supply a special converting plant.

The usual form of drive is single-reduction gearing for the larger powers when room can be safely provided, and double-reduction gear for the smaller haulages or when space is limited.

The original controllers were of the oil-immersed drum type with contactors controlling the metallic resistances. These were not only costly but occupied considerable space. Where water is available all larger controllers are now of the liquid type.

The liquid controllers consist of a tank or tanks in the bottom of which are mounted contacts connected to the rotor slip-rings. Corresponding movable contacts are carried on vertical rods actuated by a lever or by a hand wheel, the resistance in circuit being proportional to the distance apart of the fixed and moving electrodes in the electrolyte. The stator reversing-switches are fixed in the framework carrying the tank and are mechanically connected to the lever or hand wheel operating the electrodes. The liquid is cooled by pipes through which water is circulated.

The chief advantages of the liquid type of controller are the finer adjustment of the speed, especially at starting when taking up slack on the rope and shackles, and its simplicity of design, resulting in fewer working parts and greater ease of inspection. The principal disadvantage is the necessity for a supply of cooling water. The latter difficulty can be overcome where no water is available by fitting a system of radiator cooling pipes and a small motor-driven centrifugal pump. While this method works satisfactorily, it adds considerably to the first cost.

Owing to the heavy duty imposed on reversing switches of both types of controllers a special design is called for, as the frequency of operation under conditions of maximum load is much higher than that required from any other switch. To prevent overheating and formation of carbon deposit it has been found necessary to design these switches on generous lines, with an increased area of contact and a big head of oil as compared with standard switches of the same rating.

The smaller motors up to 30 B.H.P. used for driving the various auxiliaries on the surface are of the standard protected 3-phase type, wound for 500 volts. The majority of them have slip-ring rotors with liquid resistances for starting, this type of rotor being preferable to the squirrel-cage type, on account of the reduced switchgear maintenance.

Transmission System.

Experience has proved the reliability of overhead transmission with bare conductors for colliery supply. Apart from the saving in first cost, the main risk through the use of cables is avoided, namely, subsidence.

To secure safety it is advisable to screen the overhead conductors at all points where they cross traffic. The efficiency of screening is dependent on reliable earthing, which is best secured by a continuous, stranded earth-wire of substantial section, effectually earthed at each end and connected to intermediate earth-plates every 300 or 400 yards. In order to minimise risk, all main conductors round the pit head should be run as armoured cable.

The overhead system used by the Powell Duffryn Company in the Aberaman Valley was described in the previous paper.* The following modifications have been made to meet the developments in the last nine years:—

All collieries in the Aberdare Valley are now supplied by a system of 3,000-volt ring mains, protected on the Merz-Price system.

The section of the main feeders of hard-drawn copper has been increased to 0.15 sq. in. (19/12 S.W.G.), the wires being grouped in a triangle, for single circuits 3 ft. 6 in. vertically and 4 ft. 6 in. horizontally; with double circuits the conductors are carried on three cross-arms, the circuits being spaced 4 ft. horizontally and the phases 3 ft. vertically apart.

The pilot wires for the Merz-Price system consist of either one or two 3-core 7/21 S.W.G. paper-insulated lead-covered cables, suspended from galvanized steel catenary wire, 7/14 S.W.G., by raw-hide suspenders, these conductors being carried at the extremity of a fourth cross-arm fixed at about 4 ft. below the main conductors.

The average length of span is 100 ft.

Little depreciation is noticeable at the base of the creosoted wood poles, which have been erected over 10 years.

The overhead wires radiating from the Middle Duffryn power station have been displaced by 3-core paper-insulated lead-covered armoured cables to a point well clear of the power station, washery, and railways. The overhead wires branch from brick towers, in which the choking coils and horn-gap lightning arresters with liquid resistances are placed.

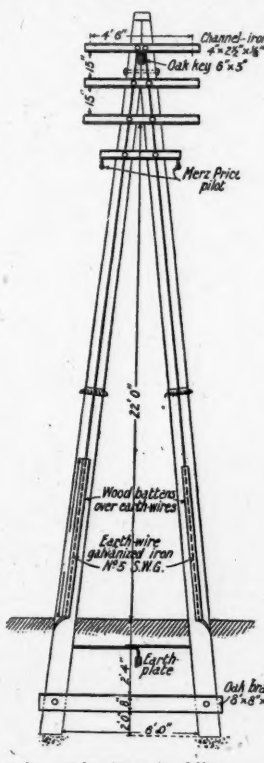
The Rhymney Valley 10,000-volt transmission lines run from Penallta to Bargoed, a distance of 3½ miles. Duplicate circuits are run between Penallta and Pengam on the same "A" and "H" poles, and between Pengam and Bargoed on separate poles, the two pole lines being about 30 ft. apart. This allows the Britannia Colliery, which is completely electrified, to be supplied from either of two power houses by two sets of duplicate transmission lines, grouped on three independent pole lines.

Wood poles are employed 36 ft. long, the maximum diameter at the base being 11½ in. and at the top 7½ in., and the pole being buried in the ground 5 to 6 ft.

The conductors are hard-drawn copper, 0.25 sq. in. section (37/13 S.W.G.). The phases are spaced vertically above one another, 15 in. apart, the two sets of transmission lines between Penallta and Pengam being 4 ft. 6 in. apart (figs. 8 and 9), and the average span being 100 ft.

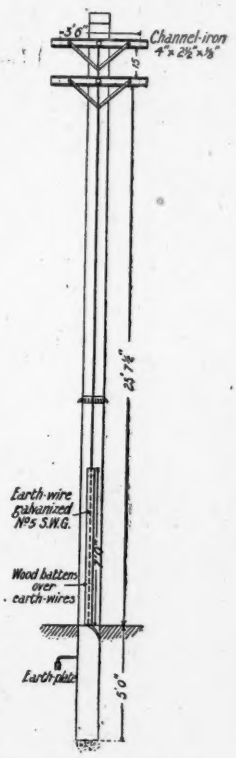
The insulators of the double-petticoat pin type are carried on three channel irons of section 4 in. × 2½ in. bolted to the poles, each insulator being subjected to a test pressure of 53,000 volts under standard precipitation, and a pressure of 75,000 volts when dry.

Each circuit is protected on the Merz-Price system, as at Aberdare, the catenary wires acting as the earth connection.



A pole carrying two sets of lines.

FIG. 8.—10,000-VOLT TRANSMISSION LINES.



Pole carrying one set of lines.

FIG. 9.—10,000-VOLT TRANSMISSION LINES.

The overhead lines are connected to the generating station and sub-stations by 3-core paper-insulated lead-covered and armoured cables 250 yards in length.

Two duplicate sets of 0.2 sq. in. hard-drawn copper (37/0.082 S.W.G.) 3,000-volt lines connect Bargoed with Elliot Pit and New Tredegar. These are also protected on the Merz-Price system. As the demand increases, the pressure on these lines will be raised to 10,000 volts.

The distance between the Middle Duffryn power station and the new Britannia Colliery is approximately nine miles. The transmission line will be constructed for a working pressure of 30,000 volts. In the first instance, however, the line will be worked at 20,000 volts, supplied through three 2,200-K.V.A. single-phase oil-insulated water-cooled step-up transformers connected so as to give 3,000 volts mesh to 30,000 volts star, and 30,000 volts star to 10,000 volts mesh. When working at 20,000 volts the transformers will be connected mesh to mesh, the ratio being adjusted when connected mesh to star by cutting out part of the neutral ends of the star winding.

The transmission line will be controlled by switchgear on the 3,000 and 10,000-volt systems, the transformers being connected direct to the transmission lines through isolating switches.

When working with transformers mesh to mesh, supplementary star transformers with the neutral earthed will be used to operate the protective system, the Merz-Hunter split-phase control being used, and the switchgear being actuated in the event of a line fault by balanced transformers connected in series with the split-phase conductors. Time-limit overload relays will be used to protect the 3,000 and 10,000-volt systems.

The power factor and the pressure drop on the transmission line when supplying from one end will be controlled by hand-regulated static boosters star-connected on the 3,000-volt system at Middle Duffryn.

The transmission lines will consist of six 0.073 sq. in. stranded conductors, each comprising 7/11 S.W.G. hard-drawn

* See Elec. Rev, April 20th, 1906.

copped wires arranged on normal spans with the phases 5 ft. apart vertically, the split phases being at 4 ft. horizontal centres.

The conductors will be carried on pin-type insulators mounted on three channel irons, these being protected by insulated sleeves so as to prevent birds operating the protective gear. Steel poles will be used, and the average length of span on straight runs will be 120 yards. For railway and road crossings a special construction will be employed, with double insulators and heavy-section screening.

A continuous earth-wire of 7/13 S.W.G. hard-drawn copper will connect the metal-work of the entire system, each transmission pole having a galvanised iron earth-plate electrically connected to the main structure of the pole.

The end connections for the transmission line will consist at each end of not less than 300 yards of 0.1 sq. in. split-phase paper-insulated lead-covered double-wire-armoured cable, the armouring being connected to the continuous earth-wire at each end and to the main earth connections at the Middle Duffryn power station and Britannia Collieries.

Fig. 5 (p. 377) shows the route of the 20,000-volt transmission line. With the completion of the latter the Britannia Colliery will be fed from three power houses by three independent routes. The annual load factor of the entire undertaking will be as high as 55 to 60 per cent., while the reserve plant in either valley will be available for the whole undertaking.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Consulting "Engineers."

Concerning consulting engineers and others mentioned by "Station Engineer" and "Ero," may I remind your readers that as far back as the Victorian Era your Correspondence columns found space for the discussion of the status of the hangers-on who impede the positive achievements of our industry, even now that it is demonstrated that the workers have outrun them in their own sphere?

There are works and factory engineers, with more electrical schemes on hand (in addition to their own routine work) than may be found in any of the top-floor back offices of the consultants. Men of the line prefer the lead of these electrically-equipped mechanics to the buffoonery of the so-called consultants whose quantities and specifications are redolent of 1885, and whose initiative is as obsolete as are their methods of measuring up a job of the looped-in type, which they often do not understand. Before me now are the specifications and quantities for a job just completed without them, they being ignored for the following reasons:—

The much "stock-phrased" specifications ridiculously divorced modern practice from the plans and quantities.

The schedule becoming useless by the discovery to the consultant and his client alike that the lighting of areas and the adaptation of power were matters nowadays better understood by the worker in practice than it was conceived by the consultant whose mental attitude towards the industry harked back to the days of the tree system and two-pole machines.

During the last three months the writer has had to return to stores huge quantities ridiculously unnecessary, and to requisition other quantities applicable by the rules and regulations but not provided for. Even since December last we have had to refuse point-blank to run mains in the same conduits carrying circuit wires, as directed—this on a split 200-volt D.C. system.

We have removed crossings shoved up into ceilings to obtain flat ceiling effects, and prevented the use of fibre in the crossings of casings, etc., none of which was objected to by a consultant (of *too* long standing).

We have fought stiff wordy battles to persuade a "specialist" that H.V. I.C. distributing boxes, etc., ought not to be fixed on the wood surfaces of flue hoists where brick or stone walls were available.

We have been "eccentric" enough to demonstrate the unwisdom of arranging a 400-volt power net-work upon the same panel as 200-volt lighting circuits, as well as being wicked enough to disagree to the fixing of pairs of S.P. lighting switches on the same base block and connected to dis-boards on opposite sides of three wires.

And, to be brief—were it not for the law of libel, much more could be said; it is sufficient, however, that there are men directing matters electrical who, being unable to *do* what they know *how* to do, are solacing their own mediocrity by occasionally escaping from their top-floor back offices to harass an industry which is forging ahead in spite of them. "Station Engineer" as well as "Ero" need be careful lest they, too, might get elbowed out of the way like

J. B.

The Government Electric Power Station at Bangkok.

In a letter dated January 4th, 1915, your correspondent "H.E.F." made certain comments in regard to this plant which, in fairness to all the parties connected with it, stand in need of some correction.

The specifications upon which the tenders were submitted were drawn up by the Siamese Government's electrical engineer, Mr. Shaw, and invitations to tender upon a definite size of plant were issued to all the well-known electrical manufacturing concerns in Great Britain, Germany and America. These facts will dispose of your correspondent's suggestion that German engineers were responsible for the size of power station and will show that in the competition for the contract, all firms, regardless of their nationality, were placed on the same footing.

It may be of interest to your readers, and satisfying in some measure to the patriotism of your correspondent, who fears for British enterprise, to point out that while it is true that the A.E.G. secured the contract, their tenders were prepared by British engineers under the supervision of the British manager of the A.E.G.'s foreign department, and British enterprise sent out a British engineer to Siam to carry out negotiations in regard to the A.E.G.'s' tender, which resulted in their securing the contract.

It is not correct, as your correspondent states, that the price quoted by the A.E.G. was much below that of all other firms competing; neither is it correct to suggest that the final cost of the plant has been increased by charging the Government with a large number of extras. If the total cost of the power station has exceeded the original Government estimate, it is partly due to unforeseen difficulties in regard to the erection of the buildings and extensions to the original scheme. The erection of the power station and its operation during the guarantee period have been carried out under the supervision of British engineers, so that German brains have had very little to do with the inception and carrying out of this scheme. This statement is due to the British engineers engaged upon it. When it is added that, although the contract was carried out by the A.E.G., who built the steam turbo-generators, the boiler-house plant was supplied by Messrs. Babcock & Wilcox, Ltd., and the switchgear and transformers by the British Thomson-Houston Co., the history of this plant may be judged in its right light. There has been no dispute, as your correspondent suggests, between the parties concerned in regard to the boiler furnaces. There was a natural desire on the part of the Government officials, the main contractors, and the boiler makers to utilise all the experience obtained in other boiler plants in Bangkok with paddy-husk furnaces, and this led to certain modifications in the original design, which the results fully justified.

In a recent letter from Bangkok informing the contractors of the successful conclusion of the tests, it is stated that as regards the boilers, the trouble taken to secure success has been fully justified, as the paddy-husk consumption has been reduced to a figure which has surprised the officials represented at the tests; moreover, with the new furnaces, an almost smokeless chimney has been obtained.

While the size of the plant may be too great for present demands, Mr. Shaw's faith in the growth of electrical enterprise in Bangkok will be justified sooner or later. Want of faith in the possibilities of electrical development has perhaps been one of the causes of the slower growth of the electrical industry in England than in Germany and America.

Bangkok.

[The fact that Mr. Shaw has not replied to the comments above-mentioned is due to his absence on active service as an officer in the armoured-car division.—EDS. ELEC. REV.]

Government Control of Factories.

Everyone has noticed the number of ridiculous statements which have been appearing in the Press recently and which has for its culminating feature the control of factories by the Government. For instance, in the House of Commons last week, it was stated there were no firms "not already engaged on Government work" in this country who could make similar goods to Siemens. We have recently, on two separate occasions, made applications to the War Office to be placed on their list of contractors, but owing to the fact that fifteen years ago one of the officials of this company offered a couple of theatre tickets to a War Office official, for this serious offence we were struck off the list. We have only one official now working for this company who was with them at the time. The directors are a totally different body of gentlemen, and yet the War Office cannot see its way clear to put us on their list. This is surely visiting the sins of the fathers, etc. The peculiar part of the whole business is that about 75 per cent. of our present output is war material through sub-contractors. We have even had a visit from one of the Government officials asking us how many men we could spare the War Office for machining ammunition, etc., and yet, in spite of all this, we are not respectable enough to be on the War Office list. It makes one feel inclined to side with those who are working for a business Government.

Walsall Electrical Co., Ltd.,
V. DELEBECQUE, *Works Manager*

Walsall, *March 12th*, 1915.

Coke Fuel for Steam Raising.

Our attention has been called to the letter signed "Engineer and Fuel Expert, London Coke Commission," who, we believe, is Mr. Nickoll (of the Gas Light & Coke Co.). The remarks he attributes to Mr. Horace Boot are incorrect, inasmuch as what Mr. Boot said at the meeting of the South Metropolitan Electric Light & Power Co. was, as correctly reported in your previous issue, that if Mr. Bowden thought he was going to get the same output from the boilers by using coke breeze as he previously could when using coal, it could only be achieved by forcing the boilers, which forcing seriously diminished the life of same. On the other hand, no doubt, by increasing the number of boilers and burning coke breeze at about 6s. or 8s. per ton, economy can be gained, as we have on several occasions intimated to our clientele.

We venture to think these remarks will be confirmed by every boiler user who has tried various classes of fuel.

Horace Boot & Partners.

London, S.W., *March 15th*, 1915.

Showroom Windows.

The writer in your issue of last week, under the heading of "Showroom Windows," has raised our expectations, and I hope will be able to fulfil them.

A good number of supply managers are interested in this question of how to dress showroom windows. The writer states that with irons, kettles, toasters, radiators, cookers, "nothing should be easier than to make an attractive display," and he finishes the article by whetting our appetite for "suggestions."

The showroom window is perhaps one of the most difficult things to deal with, that is, assuming it is a fairly large shop window. To get a continuous series of displays sufficiently attractive "for nobody to pass the shop without glancing in," as your writer mentions, requires a good deal of invention and ingenuity, when novelty has to be obtained year after year. However, your writer comes along in optimistic style, and I am sure a good many readers will be anxiously awaiting any useful hints.

May I suggest that, as we have had in technical journals quite a plethora of vague generalities, your writer should put his suggestions in a series of cut and dried specifications for a series of windows lasting over a year?

By specification I mean, not a general hint, but a detailed list of the exact apparatus to be put into the window, together with any ornamentation and any special showcards, sufficiently in detail for the specification to be put into the hands of any showroom assistant, so that by following it literally he could obtain exactly the effect that the writer would recommend. The writer should assume that there is a large shop window absolutely blank—floor, ceiling and sides.

As the writer claims to have had a very large amount of practical experience, it would also be of assistance if he could give the exact cost of dressing each window, exclusive of the actual electrical apparatus.

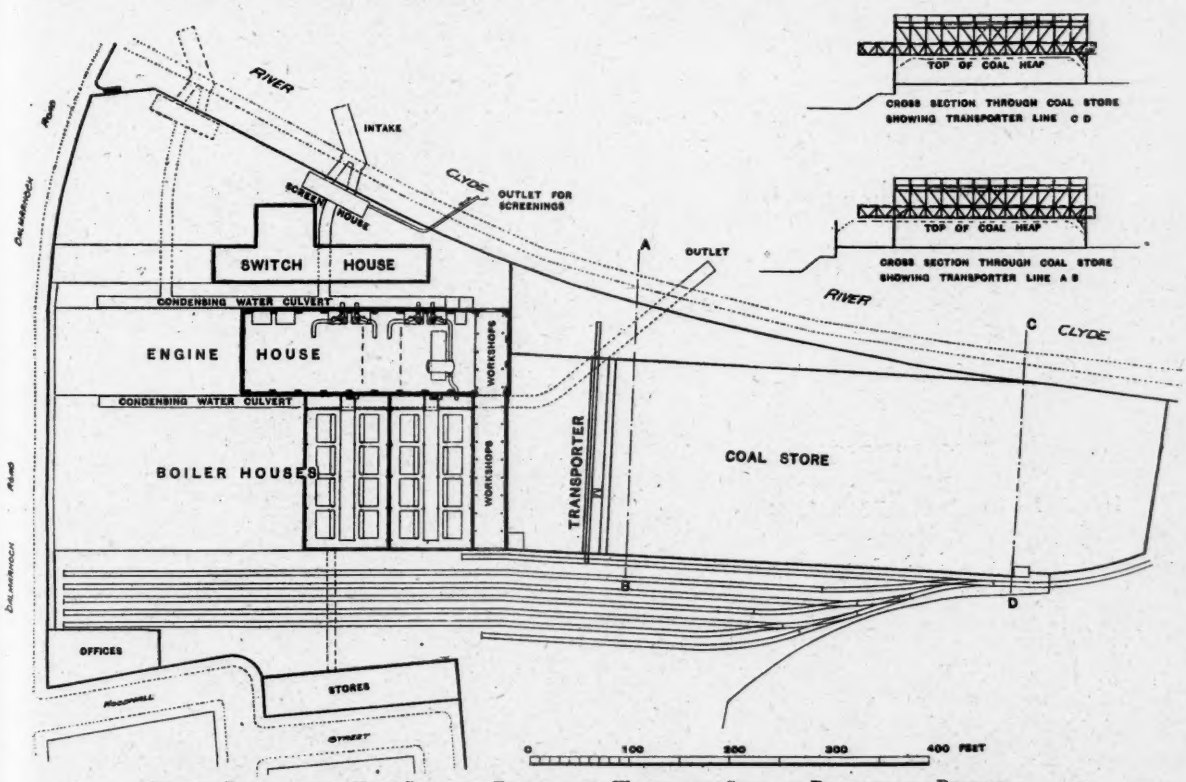
If he gives something of this kind it will certainly be practical, at least.

Electric Supply.

GLASGOW ELECTRICITY WORKS.

Mr. W. W. Lackie, Chief Engineer to the Glasgow Town Council's Electricity Department, has issued to the members of the Electricity Committee descriptive notes on the new works at Dalmarnock Bridge, of which the following is an abstract:—

The site of the Dalmarnock Road electricity works has a total area of 13¼ acres, the total cost being £27,112, and is admirably suited for its purpose. An ample supply of condensing water is obtainable from the River Clyde, and railway sidings are already laid on to the site. The first portion of the works, which is now under construction, consists of a water intake, a screening house, two water culverts (one for the inlet water and one for the outlet water), switch house, turbine room (75 ft. × 240 ft.), two boiler houses (each 150 ft. × 84 ft.), workshop and store, and a complete coal-handling plant capable of dealing with 100 tons of coal per hour. Contracts were placed for the excavation of the ground in April, 1914, and subsequently, in August, for the water channels and concrete foundations. These contracts amount to a total of £48,000. The contract for the coal-handling plant has also been placed, and the cost of this portion of the work amounts to £24,800. Offers will shortly be asked for the first portion of the buildings, and specifications for the first instalment of the plant are practically ready. This plant will consist of two 10,000-kw. turbines and one 15,000-kw. turbine, coupled direct to a.c. generators. There will also be three 1,000-kw. turbo-sets for driving auxiliary machinery; and all the necessary condensing plant and circulating pumps. It is proposed to continue installing plant units of 15,000 kw. as the demand increases, but units of 30,000 kw. can be installed if found desirable. The ultimate capacity of the Dalmarnock works will be at least 140,000 kw. It is intended to transmit electricity from the works at a pressure of 20,000 volts (three-phase alternating, 25 periods per second) to existing distributing centres at Port Dundas, St. Andrew's Cross, Govan, and Partick The energy will be transformed there from 20,000 to 6,500 volts, and distributed at this pressure to existing sub-stations where again it will be transformed to low-pressure current for the general supply throughout the city. Ducts are now being laid from the works to Cathedral Street sub-station, and the existing spare ducts from Cathedral



Sketch Plan of the New Glasgow Electricity Works and Site, at Dalmarnock Bridge.

Street to Port Dundas will be used for continuing the supply to Port Dundas. Ducts will require to be laid from Dalmarnock works to the existing sub-station in French Street, a distance of 1,200 yards; spare ducts already exist running from French Street sub-station to St. Andrew's Cross works. Ducts will require to be laid from St. Andrew's Cross works to Govan immediately, and later on additional mains from Port Dundas to Partick. It is hoped that the first part of Dalmarnock works will be ready to deliver energy at the beginning of the winter of 1916-17.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—The Board of Trade have received a translation of an article published in the January number of the monthly organ of the Moscow factory owners and manufacturers giving particulars of certain projected modifications of the Russian Customs Tariff which, it is understood, have been under the consideration of the Russian Government. H.M. Ambassador at Petrograd, in forwarding the translation, states that the information furnished in this article is in no way official, but is probably substantially correct. It appears that the proposals for tariff modification in their latest and revised form include the following:—

(1) The "Conventional" (*i.e.*, Treaty) rates of duty resulting from the Russian Commercial Treaties with Germany and Austria are to be abrogated, and the goods covered by those rates are to be dutiable at the "General" Rates (i.e., higher), rates of duty increased by 10 per cent. (except as regards certain goods mentioned, of which glassware is probably the only one of interest to the electrical trade, the duty on which is to be increased by about 30 per cent.).

(2) No change is to be made as regards goods the duties on which are fixed by the Russian Commercial Treaties with France, Italy and Portugal. These duties are also applicable to British goods.

(3) All other goods and those other than certain named, but not of interest to the electrical trade, are to pay the existing "General" tariff rates of duty increased by 10 per cent.

The effect of these alterations on British goods is not yet quite clear from the details available, but the Board of Trade promise to publish in due course a translation of the tariff showing in detail the effect of these proposals. Meantime, it would seem that, with the exception of goods covered by the Treaties with France, Italy and Portugal, British goods will still be dutiable at the same rate as German goods, and that the duties in both cases will be considerably higher than heretofore.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,241. "Ceiling roses and the like electrical accessories." R. T. Grocott. March 1st.

3,244. "Electric lamp holders and similar couplings." A. A. Schashke. March 1st.

3,261. "Electric light fittings." G. Maurice & F. T. Cash. March 1st.

3,277. "Porous radio-active bodies and process of producing same." R. J. Tugwood (Radium Therapy Corporation, United States). March 1st. (Complete.)

3,283. "Electric controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States). March 1st. (Complete.)

3,284. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 1st. (Complete.)

3,300. "Electric conductors or cables." W. E. Hitch. March 2nd.

3,302. "Electric dry cells." A. E. Sampson. March 2nd.

3,303. "Electrical alarum switch." T. P. Dunkerley. March 2nd.

3,321. "Electric means of attacking submarines and other war ships, and also of attacking Zeppelins or other aircraft." R. P. Williams. March 2nd.

3,326. "Secondary electric batteries or accumulators." W. S. Naylor. March 2nd.

3,329. "Sanitary telephone mouthpiece." Ed. M. Jenkins. March 2nd. (Complete.)

3,364. "Manufacture of electric insulating materials and the like." March 2nd. W. E. W. Richards.

3,366. "Telephone exchanges." International Electric Co., Ltd., R. G. le Noir, & E. Funccius. March 2nd.

3,369. "Electric insulators." Soc. Ceramica Richard-Ginori. (Convention date, March 5th, 1914, Italy.) March 2nd. (Complete.)

3,379. "Electrical device to be used on taxi cabs and the like." E. J. Matthews, H. Richardson, & F. Henry. March 3rd.

3,386. "Railway signalling apparatus for automatically warning the engine-driver or guard as to the position of the signal and including means for telephoning to the train from the signal cabin, and for automatically stopping the train from running past a signal at danger." E. Sutton. March 3rd.

3,409. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whittaker. March 3rd.

3,411. "Means for connecting electrical conduits to their fittings." A. Myers & F. R. Baker. March 3rd.

3,433. "Reactance coils." P. Torchio. March 3rd. (Addition to 11,116/14.) (Complete.)

3,434. "Magnetic compasses." W. B. Ritchie & R. H. McDowell. March 3rd.

3,439. "Sparking plugs for internal-combustion engines." Soc. Industrielle de Delle. March 3rd. (Convention date, May 8th, 1914, Belgium.) (Complete.)

3,442. "Method of and apparatus for burning carbon electrodes." Georg Mendheim (firm of). March 3rd. (Convention date, March 4th, 1914, Germany.) (Complete.)

3,445. "Telephone or other electrical transmitter or receiver diaphragms." B. A. Pilkington. March 4th.

3,455. "Methods of laying wires, cables, pipes and the like underground." E. H. Hobling. March 4th.

3,490. "Electric switchgear." F. Waller. March 4th. (Complete.)

3,500. "Automatic electric circuit breakers." H. H. Groves & H. Britain. March 4th.

3,502. "Induction motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 4th.

3,505. "Distribution or fuse boxes for electric circuits." F. B. Holt. March 4th.

3,507. "Means for receiving signals by sound." Marconi's Wireless Telegraph Co., Ltd., & R. D. Bangay. March 4th.

3,513. "Electric heating element." Cable Accessories Co., Ltd., & F. H. Reeves. March 4th. (Complete.) (Addition to 24,565/13.)

3,520. "Electric signalling." International Electric Co., Ltd., H. E. R. Roose, & R. G. le Noir. March 4th. (Complete.)

3,521. "Portable electric battery lamps." M. Goodfellow & New British Ever-Ready Co., Ltd. March 4th. (Complete.)

3,523. "Electric signalling systems." International Electric Co., Ltd., H. E. R. Roose, & R. G. le Noir. March 4th. (Complete.)

3,524. "Transformer for use with polyphase generators for high-frequency currents." L. Rouzet. (Addition to 519/15. Convention date, March 14th, 1914, France.) March 4th. (Complete.)

3,546. "Wireless control for operating machinery." J. J. Denton & A. G. Macculloch. March 5th.

3,554. "Electric torches." S. J. Levi. March 5th.

3,565. "Arrangements for operating switching devices by electric current impulses. O. Imray (Siemens & Halske Akt. Ges., Germany). March 5th. (Complete.)

3,569. "Method and apparatus for the electro-deposition of metals." C. E. S. Bell & L. G. Scott. March 5th.

3,570. "Electric controller." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 5th. (Complete.)

3,614. "Flat joint for teapots, coffee-pots, kettles and the like in electro-plate ware." G. Edwards. March 6th.

3,627. "Electric batteries." F. J. Beaumont. March 6th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

26,068. Gyroscopic Compasses. J. B. Henderson. November 13th.

26,160. Gyroscopic Compasses. J. B. Henderson. November 14th.

28,933. Reversing and Braking of Alternating-current Motors. Akt. Ges. Brown, Boveri, et Cie. December 15th. (December 27th, 1912.)

1914.

174. Machines for Generating Electrical Energy. C. T. Mason. January 3rd.

901. Electric Railway, Tramway, and like systems. J. A. F. Aspinall. January 13th.

1,940. Magnetos for use on Internal-combustion Engines. Humber, Ltd., and J. A. Cole. January 24th.

2,739. Dischargers for producing Electric Oscillations. R. C. Galletti and R. Manzetti. February 2nd.

3,191. Radio-telegraphic and Radio-telephonic Receiving Systems. G. O. Squier. February 6th.

3,722. Electric Heating Apparatus. A. F. Berry. February 12th.

3,831. Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.). February 13th.

4,184. Method of Manufacture of Heating Conductors for Thermic Telephones from Platinum Wires treated by the Wollastone Process. P. de Lange. February 18th. (May 8th, 1913.)

4,203. Method of Manufacture of Heating Conductors for Thermic Telephones from Platinum Wires treated by the Wollastone Process. P. de Lange. February 18th. (June 3rd, 1913. Addition to 4,184/14.)

4,235. Electric Conductors. British Thomson-Houston Co. (General Electric Co.). February 18th.

4,236. Electric Lifts. M. D. Scott & Medway. February 18th.

4,323. Electric Telemotors for Reproducing Movements at a Distance. W. H. Scott. February 19th.

4,489. Machine-switching Telephone Exchange Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 21st.

4,735. Electrically-operated or Controlled Presses. A. H. Railing, A. Pelcock, & T. H. Hutchinson. February 24th.

4,815. Long-stroke Electro-magnets and Reciprocating Electro-magnetic Mechanisms and the like. F. T. Chapman. February 24th.

5,431. Electrical Switches. B. D. Horton. March 3rd.

5,668. Eyes for Ropes, Wires, Cables, and the like. F. R. Beckett. March 6th.

6,573. Structures of Insulating or Fire-resisting Material. Turner Bros., Ltd., and H. R. Turner. March 16th.

8,821. Electric Cut-outs. British Thomson-Houston Co. (General Electric Co.). April 7th.

10,251. Indicators. F. G. Brettell (Apple Electric Co.). April 25th.

11,165. Electrical Energy Supply Installations. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, & G. Pegg. May 6th.

11,840. Electric Switches. F. E. Wilson. May 13th.

13,058. Lamp Reflectors. W. C. Wise. May 27th.

14,027. Illuminating Apparatus. Aktiebolaget Lux. June 10th. (June 16th 1913.)

14,474. Electric Fuses. W. D. Hensell. June 16th. (June 18th, 1913.)

15,598. Antiseptic Protectors for Telephones. T. Lamb. June 29th.

18,810. Electric Primers. C. F. Lindsay. August 18th. (September 8th 1913.)

1915.

516. Means for Operating the Collapsible Cover for the Upper Deck of Omnibuses, Tramcars, and the like. F. H. Beck. January 12th. Addition to 3,657/14.)